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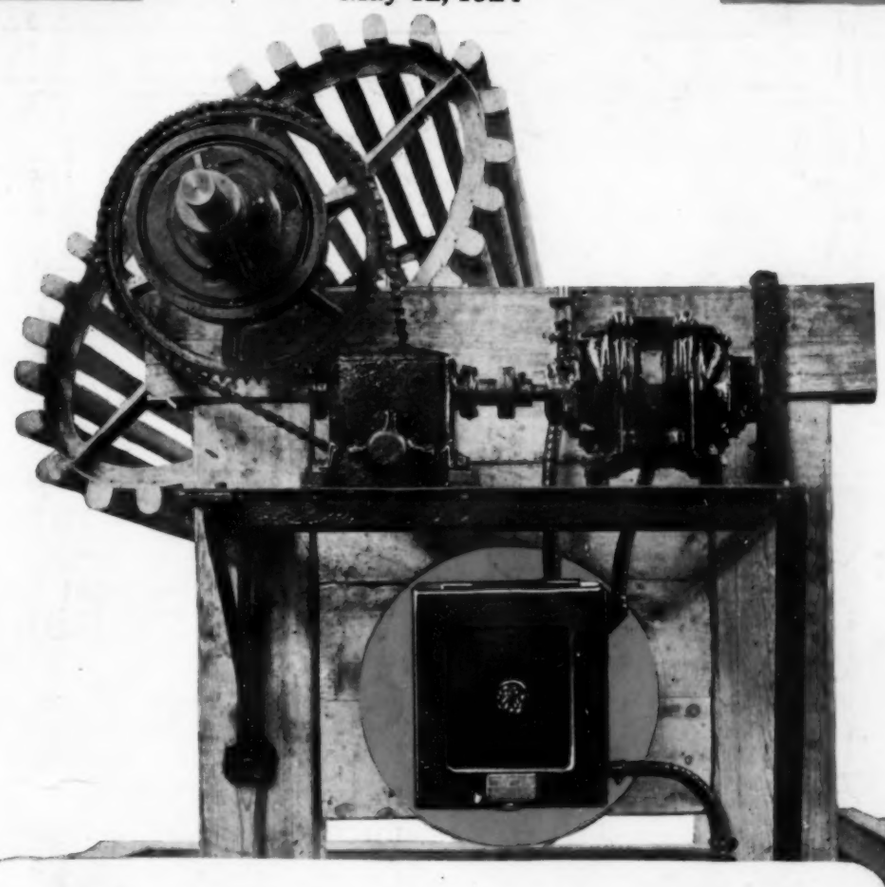

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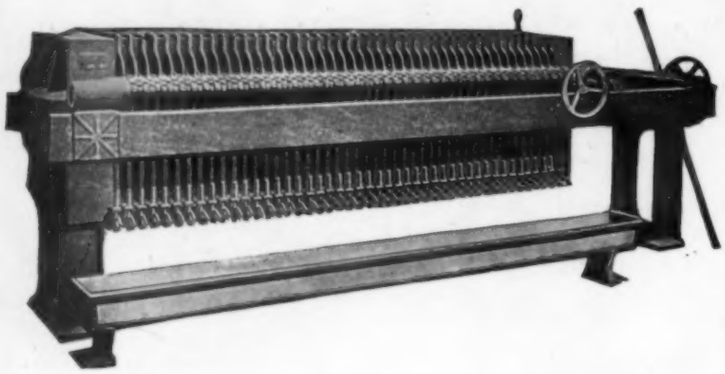

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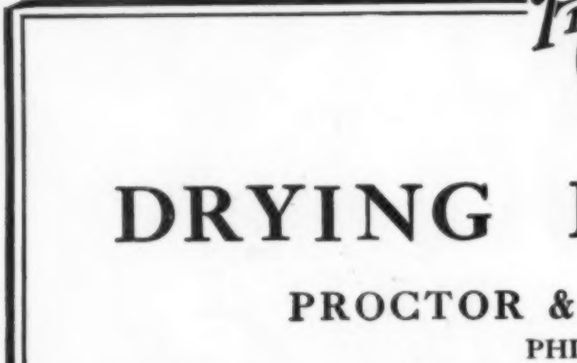

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CHEMICAL & METALLURGICAL ENGINEERING

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The Trend In Business

WHILE it is frankly recognized that in many lines of industry and trade there is a slackening of business and decreased production, economists and competent business critics are of the opinion that conditions in the country are fundamentally sound and that no undesirable results are likely to follow the present depression. Considering the large surplus of gold in the country, the present trend toward lower levels of production is probably better than a sharp turn upward, due to the danger of inflation that would follow a boom.

The chemical industry has been adversely affected by the unfavorable condition in the large consuming industries such as textile and leather. Furthermore, there is a feeling that the chemical industry has not yet curtailed its operations to conform to peace-time demands, with the result that there has been some overproduction and accumulation of stocks. There are isolated examples of other industries that are enjoying exceptional prosperity. The construction industry has for some time past been the backbone of industrial activity. The automotive industry also continues to thrive, and a prominent manufacturer of material-handling equipment reports an upward trend in business throughout the country, with prospect of larger buying if federal legislation still further restricts immigration.

The present situation must be regarded as one of those minor fluctuations in business resulting from a multiplicity of causes. It is time for a readjustment of production to consumption. Any attempt to improve business by forcing a boom would be disastrous, because present conditions are so favorable to inflation that business might rise to a very high peak from which it would subsequently recede to an equally deep valley of depression. It is believed that before business slows down much further both domestic and European conditions will improve to such an extent that production can be resumed on an even keel and in profitable volume.

Metric Medicine With Latin Labels

IN A recent issue of the News Edition of *Industrial & Engineering Chemistry* Dr. E. C. Bingham contributes a short note on the gradual adoption of the metric system by physicians in writing prescriptions. It appears that the practice of substituting grams for drachms, scruples and minims is growing in popularity among practitioners and is used exclusively at a number of medical colleges and hospitals. Dr. Bingham illustrates the advantages of the metric system by reproducing the same prescription in two forms, one carrying the unintelligible apothecary's units and the other the simpler metric measurements. The improvement is obvious even to one who is not familiar with other advantages of the metric system.

It was not within the scope of Dr. Bingham's note to make further criticism, but the chemist cannot read the Latinized names of the constituents of the prescription without feeling that there is room for improvement. If apothecary units look like Egyptian hieroglyphics, the Latinized jargon of the drug store suggests the learning of the dark ages when the charlatan impressed his dupes with signs and symbols. It is a happy augury that the medical schools are giving up the apothecary system of weights. They should also clean house with respect to Latin labels. While a medical student is memorizing "Tincturæ Nucis Vomicæ" and "Sodii Bicarbonatis" he could be learning some real chemistry.

Trade Associations And Business Ethics

INDIVIDUAL and group relations in modern business have grown more complex with advancing civilization and will continue to increase in complexity with the progress of science and the growth of population. New problems arising from these complexities are calling for new adaptations of old and well-known standards of conduct and new applications of old principles of ethics. If business is to escape the blight of governmental regulation, if it is to quiet popular clamor against practices that are not in the public interest, it must take voluntary action to quicken its own conscience and eliminate abuses. Such is the thesis of an admirable speech by Secretary Hoover at the annual meeting of the Chamber of Commerce of the United States in Cleveland last week—a speech that should be studied carefully, because it represents the sound judgment of the Secretary of Commerce matured by 3 years of close official contact with American business.

Mr. Hoover sees the economic life of the nation undergoing a vast transformation, from a period of extremely individualistic action to one of associational or group activities. And with this change comes the necessity for standards of group conscience and group ethics which must be just as high and spring from as lofty motives as those that determine individual character. In short, business through its trade and other associations must exhibit the same fine moral preception that we demand of individuals if it is to cure its own troubles instead of having them treated, and possibly not cured, by government.

The highest function of government is to maintain human rights. The increasing number of laws annually put upon the statute books is an evidence not only of the attempt to protect society in its recognized rights but also of the need for new rules and regulations to meet the complexity of modern business conditions. These laws will continue to be made to insure fair play and square dealing, to prevent abuse and imposition. The question raised by Mr. Hoover is whether business

itself shall regulate its affairs voluntarily or suffer from the clumsy attempt of government to protect the people from bad business practice and low standards of ethics. And his answer is that American business will be far more secure in its prosperity through the observance of self-imposed standards of morals that will engender public confidence.

With American industry and trade as thoroughly organized as it is through trade associations, chambers of commerce, labor unions, professional bodies and the like, Mr. Hoover believes we have "the method at hand for voluntary organized determination of standards and their adoption." In the trade association particularly he sees a medium for the recognition of public responsibility on the part of business. Such dangers as may lie in associational activities will, in his judgment, "come only from low ethical standards." Self-governing industry is his ideal which will "render needless a vast area of governmental interference and regulation which has grown up out of the righteous complaints against abuses during the birth pains of an industrial world."

Following his customary style, Mr. Hoover's speech is marked by terse, epigrammatic expressions of business wisdom. As a government official Mr. Hoover knows the undesirability of too much government in business, but he says that "when legislation penetrates the business world it is because there is abuse somewhere." His recognition of the benefits of co-operative effort is expressed in the belief that "industry and commerce are not based upon taking advantage of other persons." His faith in trade associations as constructive agencies for good in business is in contrast to the gloomy forebodings of those who see in such activities only a conspiracy to fix prices and restrain trade. Recogognizing the existence of "some crooks in every line of endeavor," he dismisses this minority that needs the application of criminal standards by saying that he has in mind "something more vital than porch climbing." That his feet are on the ground he demonstrates by showing the accomplishments of co-operative effort in the lumber and coal industries, in which voluntary agreements have eliminated abuses against which congressional attack has been unsuccessfully directed for many years. Government co-operation will always be forthcoming to aid trade associations in raising and enforcing standards of business conduct, but if the effort is to be most effective it must be based upon a recognition of the need of high moral standards. "American business needs a lifting purpose greater than the struggle of materialism."

Interdependence of Chemistry and Physics

INTERPRETATION of puzzling phenomena in processes that depend on some fundametanl chemical reaction might sometimes be aided if it were realized that it is impossible to express, in terms of a chemical equation, every reaction that occurs. In the early application of the cyanide process for the treatment of gold and silver ores, much research was concentrated on the abstraction of gold or a gold compound from aurocyanide solution by carbon; and chemical combination was viewed as the only possible explanation of the phenomenon. Only in comparatively recent years was the adsorption theory advanced and substantiated, the result being a quickening of research on the commercial application of the reaction. A bugbear became a prospective process of recovery. Unfortunately, however, few physical chemists have investigated this prospective application of a recognized principle, although researches at Columbia University promise additional light on the subject.

These comments were prompted by the publication in a recent bulletin of the Institution of Mining & Metallurgy of figures dealing with the peculiar action of the oxidized ore from the Shamva mine, in Rhodesia, when brought into contact with aurocyanide solution. Four samples, each containing gold valued at about $1.75 per ton of ore, were finely ground and agitated with a cyanide solution containing about $45 of gold per ton. The excess solution was then removed by filtration and the residue given several washes and decantations, finally treated on a vacuum filter, dried and assayed. It was found to contain about $12.50 per ton in gold. The important lesson to be learned from this result is the danger of permitting contact of high-grade gold solution with some classes of ore gangue; in other words, it is a wise precaution, if practicable, to impoverish a rich material by a mechanical process, such as amalgamation or concentration, before chemical treatment is begun. In the test described, the grade of the solution used was abnormal, and seldom found in practice except in the treatment of concentrate; but a continuous loss of even a minute amount of recoverable gold per ton of ore in ordinary practice is sufficient to justify research. An exaggeration is often needed to draw attention to a condition that deserves attention.

This sidelight on a commercial chemical process indicates the need for an appreciation of physical chemistry and an understanding of the phenomenon of adsorption and the effect of surface-tension influences on the the stability of a solution of gold in cyanide. In the instance under review, a continuous loss of gold in the residue from the cyanide plant, in consequence of the peculiar and unexplained action of some constituent of the ore, is recognized as an unavoidable concomitant to normal operating practice. The loss is probably small—in proportion to the lowness in grade of the ore treated. In other instances, however, it is evident that a mistaken idea sometimes prevails as to the solubility of gold in cyanide solution because of the difficulty in detecting how much of the precious metal is dissolved in the first instance, and how much of this is subsequently adsorbed and held in contact with the ground ore in spite of ordinary washing operations.

In one instance the gold from aurocyanide solution that had been adsorbed by graphitic schist in an ore was freed by an after-treatment with sodium sulphide, the most plausible explanation of this reaction being that the adsorption equilibrium was upset by the change in the composition of the surrounding solution. The solubility in alcohol of picric acid that has been adsorbed by platinum black is a parallel instance.

The cyanide process, although a chemical industry of vast world importance, has almost escaped the attention of the physical chemist. Bancroft's "Applied Colloid Chemistry" makes no mention of the many phases of cyanidation that are influenced by colloidity and adsorption, or the important effects of the extreme subdivision of inert matter on an unstable solution of considerable value, with which the ore is in contact during the extraction stage of operations. The field is one that offers interest and promise.

Selection Factors in Choosing

Refractories for Industrial Plant Use

The Accompanying Article and Table Contain the Basic Facts Upon Which the Engineer Must Base His Choice of a Refractory

By O. A. Hougen

Assistant Professor Chemical Engineering, University of Wisconsin

IT IS obvious that there is no universal refractory fulfilling all demands, but in the selection of refractory ware a compromise must always be made so as to fulfill the most important requirements at the expense of minor desirable properties.

The general requirements of all refractories for high-temperature work are high softening point, mechanical strength at high temperatures, resistance to sudden temperature changes, chemical inertness toward any solid, liquid or gas with which it may come into contact and permanency of volume in use subsequent to manufacture. This last requirement necessitates that the raw materials should previously be calcined and shrunk, preferably by electrical fusion, to the least volume before bonding and that the bonded ware should be initially fired to a temperature exceeding any temperature to be encountered in subsequent use. It has militated against the development of super-refractories, because it is difficult to obtain uniformly heated commercial furnaces, operating above 1,800 deg. C., for firing such ware. The production of super-refractories will depend largely upon the development of such furnaces.

Certain industrial conditions demand other properties in addition to those listed above. Externally heated crucibles, furnace tubes, muffles and pyrometer tubes require a high thermal conductivity and low permeability to gases. Refractories subject to frequent handling and wear should possess hardness and resistance to abrasion. Electrically heated crucibles and wire-wound furnaces should possess high electrical resistance. Refractories used for thermal insulation should possess a low thermal conductivity and low heat capacity in order to minimize heat losses and effect a more uniform temperature control. Refractories for electrical heating elements should possess sufficient electrical conductivity to enable them to carry a heating current with a reasonably low potential drop.

Usually refractory materials are bonded with various ceramic bonds in order to give the shape mechanical strength during all the processes of manufacture such as molding, drying and baking, and also to permit firing at a low temperature. This is done at the expense of lowering the temperature of softening. Recent progress in manufacture has resulted in producing ware from the pure refractory material by bonding with a portion of material shrunk in an electric furnace which has been rendered plastic by water grinding. In this process the pure refractory material will sinter at a temperature several hundred degrees below its actual melting point. The ware produced from the simple oxides by this process does not possess high mechanical strength at high temperatures above 1,600 deg. C. This is true of magnesia, alumina, zirconia and chromium oxide. However, binary compounds of these simple oxides may be bonded by this method, with the production of ware possessing greater mechanical strength at high temperatures, as well as being more resistant to reduction by carbon, and more resistant to fusion by fused acids and alkalis. This has resulted in the development of such super-refractories as sillimanite, spinel, zircon and chromite.

Attempts have also been made to make pure refractories by casting the fused materials. This process has proved unsuccessful except in the case of glass and silica.

The properties of the common refractory materials, both bonded and unbonded, are tabulated herewith.

Refractories possessing high thermal resistance for use above 1,200 deg. C. have not been developed industrially. Thermal insulation of all refractory materials is decreased with increase in grain size, with calcination and with bonding.

Finely powdered materials such as magnesia, alumina, diatomaceous earth, lime, carbon and graphite, when dry and uncalcined, are excellent heat insulators. Carbon and graphite, however, cannot be used at temperatures above 600 deg. C. in an oxidizing atmosphere. Magnesia, alumina and diatomaceous earth cannot be used above 1,000 deg. C. because of excessive shrinkage. Lime may be used to high temperatures without shrinking.

Finely powdered materials made from the thoroughly calcined or electrically fused refractories possess higher thermal insulation than the bonded form. However, these powders sinter together at temperatures above 1,000 deg. C. and far below their melting point. For this reason they should not be used in contact with furnace parts that require frequent renewal.

Bonded diatomaceous earth possesses the highest thermal resistance of any bonded insulator commercially developed. This material is used on an extensive scale for insulating industrial furnaces. The powdered and bonded forms begin to shrink at 1,000 deg. C. and will not withstand direct flame action. One special type of bonded siliceous material produced by partial calcination may be safely used up to 1,200 deg. C. without shrinking.

The author gratefully acknowledges the generous suggestions of the following men: Dr. E. W. Washburn, of the National Research Council; M. C. Booze, Senior Fellow of the Refractories Manufacturers' Association, and M. F. Beecher, research engineer, Norton Co.

Physical and Chemical Properties of Refractory Materials

Compiled by O. A. Hougen, Assistant Professor, Chemical Engineering Department, University of Wisconsin, for *Chem. & Met.*

Material	Composition	Resistance to Chemical Action 1000° C to 2000° C: Resistance to Basic Fluxes*	Resistance to Acid Fluxes*	Resistance to Oxidation (by Air)	Resistance to Reduction* (By Carbon and Reducing Gases)	Resistance to Molten Metals (when free from oxides)	Softening Point °C	Fusion Point °C	Deformation Under Load (Under a Compression Load 50 lb./sq.in.)	Coefficient of Expansion (Linear)
Alumina (Granular)	Al_2O_3	Readily attacked. Soluble in fused alkalis, more readily in fused $K_2S_2O_7$ and $Na_2B_4O_7$. Attacked by strongly basic slags and vapors (12) Resists basic fluxes in lime and cement kilns (82)	Readily attacked. Attacked by fused silica and siliceous fluxes	Not attacked	Attacked appreciably by amorphous C at m.p. but not as readily by graphite (3). Forms carbide slowly at 1800° C (1) Not reduced by dry pure H_2 at 2500° C and 150 atm. (2).	Not affected		2010° C (7) [99.5% Al_2O_3] 2075 ± 25° C (8) 2000 ± 50° C (8) [92-96% Al_2O_3]		$.72\times10^{-6}$ (25 to 900° C) (9) $.73\times10^{-6}$ (25 to 900° C) (9) $.80\times10^{-6}$ (25 to 900° C) (9)
Alumina (Bonded)							1950° C (best grade) (8) 1300° C (inferior grade)	2050° C (14)	None at 1550° C (14)	$.71\times10^{-6}$ (9)
Alumina-Silica (Granular)	Chiefly $3Al_2O_3.2SiO_2$, the only stable silicate of alumina at high temperatures	Slowly attacked	Not attacked	Not attacked	Not readily reduced	Not affected		1860° C (42) Eutectic with Al_2O_3 at 1810° C Eutectic with SiO_2 at 1600° C		48×10^{-6} (25-900° C) (9)
Alumina-Silica (Bonded)							Almost to f.p.		None at 1350° C Rigid to within a few degrees of f.p. (44)	
Porcelain (Bonded) (Refractory Grade)	Chiefly $3Al_2O_3.2SiO_2$	Slowly attacked	Not attacked	Not attacked	Not readily reduced	Not affected	1630° C (54) 1650° C (65) 1200-1300° C (inferior grades)	1500°-1550° C (Impervite) 1350-1400° C (Impervite-glazed) Above 1600° C (65)	None at 1350° C (best ware)	$.28\times10^{-6}$ (Berlin Pore.) $.44\times10^{-6}$ (20-1050° C)
Magnesia (Granular)	MgO	Not attacked	Readily attacked. Reacts with fireclay at 1600° C (48) and with silica brick at 1610° C (49)	Not attacked	Very slightly reduced at 1450° C. (45); at 1500° C. (46). Forms no carbide (47). Reduced rapidly only above 2000° C.	Not affected	B	2800° C		1.14×10^{-5} (120° C) (50) 1.28×10^{-5} (270° C) (50)
Magnesia (Bonded)							Becomes weak at 1300° C (pyrometer tube)	2165° C (brick) (28) 2250-2800° C (brick) (7)	Shears at 1410° C (brick) (30) Shears at 1555° C (brick) (31) Pure MgO fails at 1680° C with 7.5% SiO_2 at 1870°C (46) (Fired at 2100° C)	1.26×10^{-6} 14 = 1200°C (83) 1.61×10^{-6} 0 = 1430° C (88)
Spinel (Granular)	$MgO.Al_2O_3$	Not attacked	Not attacked readily	Not attacked	Not readily reduced	Not affected		2135° C (4) Eutectic with Al_2O_3 at 1925° C Eutectic with MgO at 2030° C		
Spinel (Bonded)							1910° C (brick) 2117° C (best ware)		None at 1350° C Rigid to within a few degrees of f.p.	
Silica (Granular)	SiO_2	Readily dissolved	Not attacked except by fluorides	Not attacked	Very slightly reduced at 1050° C. (57) (58). Forms carbide 1600±50° C. Rapidly at 1840±30° C. (19)	Not attacked by molten Sn, Cd, Zn and S.		β Quartz 1600-1670° C Tridymite (γ) 1670° C Crystobalite (β) —1710° C (88)		
Silica (Fused and Bonded)							1400° C Devitrifies at 1100°C (depending upon atmospheric conditions)	1700-1750° C		$.54\times10^{-6}$
Highly Aluminous Refractories		Same as for alumina	Not readily attacked	Not attacked	Not readily reduced	Not attacked		1835-1915° C (96)	1.13% at 1350° C (50 lb./sq.in.) (96) 10.7% (1538-1552°	

Highly Aluminous Refractories		Same as for alumina	Not readily attacked	Not attacked	Not readily reduced	Not attacked		1835-1915° C (96)	1.13% at 1350° C (50 lb. /sq.in.) (96) 10.7% (1538-1552°	
Carbon (Amorphous) (Bonded)	C	Oxidised at high temperatures by fused oxides and by fluxes containing combined oxygen	Oxidized at high temp.	Oxidizes in air appreciably at 550° C	Not affected	Not attacked by molten Cu, Zn, Al, Au, Sb, Sn, Ag, Pb, Cd. Contaminates Pt, Fe, Ni, Co, Pd, Cr, Si.	Above 2000° C.	Rapid growth of crystals above 2000° C.	None below 1800° C	.54 × 10⁻⁶ (88)
Graphite (Bonded)	C	Oxidized less readily than amorphous carbon	Less readily attacked than amorphous carbon. [Not attacked by fused salts, containing no oxygen, e.g. Ca *f'z*]	Oxidizes in air appreciably at 640° C (61). [Not attacked by gases such as Cl_2, Br_2, HCl]	Not affected	Same as amorphous C.	Above 2000° C	4400° C Sublimes at 3900° C (1 atm.) (88)	None below 1800° C	.78×10⁻⁶ (40° C)
Silicon Carbide (Granular)	SiC	Readily attacked. Decomposed by fused alkalis and alkali sulphates. Decomposed by sodium silicate at 1300° C, especially in presence of oxidizing agents. Reacts with CuO at 800° C FeO at 1300° C NiO at 1300° C MnO at 1360° C CdO at 1370° C CaO and MgO at 1000° C	Not readily attacked Reacts with SiO_2 at 2000° C [Not attacked by fused $KClO_3$ or KNO_3.] (16)	Rapidly oxidizes above 1750° C (16). No oxid. in pure O_2 at 1000° C. Slightly in air, 1000-1350° C. Silica formed retards further oxidation 1500-1600° C. CO_2 active above 1800° C. Attacked by Cl_2 at 600° C.	Not affected	Quite similar to C. Not affected by Zn, Cu. Readily contaminates Pt, Fe, Co, Ni, Cr, Pd.		Decomposes at 2220° C (17) 2220°±20° C(18) 2240±5° C (19)		6.58 × 10⁻⁶ (15-100° C) (23) 4.38 × 10⁻⁶ (700-800° C) (23) 2.98 × 10⁻⁶ (800-900) (23) 4.35 × 10⁻⁶ (1000 ± 15° C) (23) 5.39 × 10⁻⁶ (100-200° C)
Silicon Carbide (Bonded)							Recrystallized ware does not soften below 2200° C Depends upon bond for other ware (1400°-2000° C)		None at 1650° C (27)	4.7×10⁻⁶ (100-900° C)
Zirconia (Granular)	ZrO_2	Not attacked Resists fused cyanides and alkalis	Readily attacked by fused fluorides	Not attacked	Forms carbide at high temps. Rapidly at 2400° C (29)	Not attacked		2720° C (87)		.84 × 10⁻⁶ (29)
Zirconia (Bonded)							1800-1900° C. (84)	2563-2600° C (27) (29) (brick)	Fails at 1420° C (75 lb.) (brick) Fails at 1520° C (50 lb.) (brick) Fails at 1600° C (25 lb.) (brick)	
Zircon (Granular)	$ZrO_2 . SiO_2$	Not attacked readily by basic slags. Readily destroyed by iron sulphide, fluorspar and caustic	Not readily attacked	Not attacked	Not readily reduced	Not attacked		2550° C (87) Eutectic with ZrO_2 at 2300° C		.443 × 10-4 (40° C) (75)
Zircon (Bonded)									Fails at 1510° C	
Chromite (Granular)	$FeO.Cr_2O_3$	Not attacked readily. Decomposed by fused K- and Na- bisulphates. Attacked by fused NaOH and by CaO at high temperatures	Not readily attacked. Molten silica has a fluxing action (59)	Not attacked	Reduced to ferrochrome at high temps. (59)	Not attacked		2180° C (7)		
Chromite (Bonded)								2050° C (brick) (28)	Bonded Fails at 1510° C (brick) (31) Fails at 1450° C (brick) (30) Fails at 1400° C (brick) (31)	.902 × 10⁻⁶ (81) 1.07 × 10⁻⁶ = 1500° C (88)
Fireclay (Bonded) (Brick)		Attacked readily, especially when silica content is high	Not readily attacked	Not attacked	Not readily reduced below 1400° C.	Not recommended above 1300° C.	1500°-1600° C (best ware)	1500-1750° C	Slight deformation at 1350° C (best) Fails 1350-1500° C	.59 × 10⁻⁶ (83)
Silica Brick	SiO_2 96%	Readily attacked	Not attacked except by fluorides	Not attacked	Same as for silica	Same as for silica	1700-1750° C	1700-1750° C	Fails at 1700° C (92) (Load 171 lb./sq.in.)	1.21 × 10⁻⁶ (14-1200° C) (83) 1.29 × 10⁻⁶ (0-1010° C) (88)
		*In general the action of hot conc. caustic solutions is similar to the action of basic fluxes	*In general the action of conc. mineral acids at low temps. is similar to the action of acid fluxes		*Above 2000° C. all oxides and silicates are reduced by C. Bricks containing iron oxide are readily reduced by CO below 550° C. (86)					

Physical and Chemical Properties of Refractory Materials—Continued

Material	Resistance to Spalling	Apparent Density	True Specific Gravity	Thermal Conductivity (Gram calories/cm. cube/° C/second)	Electrical Resistivity (Ohms per centimeter cube)	Hardness (Mohs Scale)	Resistance to Abrasion	Specific Heat	Total Emissivity	Index of Refraction (Na light)
Alumina (Granular)			α 3.93 to 4.01 (3) β 3.03 ± .01 (4)	0.00162 (47° C) (88)		9+		0.1827 (5) 0.200 (6) 0.279 (20-2030° C) (89)	0.10 (500° C) (87)	α Al_2O_3 $N_{a\epsilon}$ = 1.760 $N_{a\omega}$ = 1.769 β Al_2O_3 $N_{a\epsilon}$ = 1.63 $N_{a\omega}$ = 1.66
Alumina (Bonded)	Fair	2.6	3.6	Bonded 0.0083 ± 0.0004 (1250-650° C) (13) 0.0068 (above 900° C) (15)	47,600,000 (535° C) (8) 4,900,000 (721° C) (8) 2,400,000 (908° C) (8) 750,000 (1040° C)		Good	0.198 (14)		
Alumina-Silica (Granular)			3.23 (44)			6-7		0.1684 (0-200° C) (88)		$N_{a\alpha}$ = 1.638 $N_{a\beta}$ = 1.642 $N_{a\gamma}$ = 1.653(14)
Alumina-Silica (Bonded)	Good	2.2 (44)	3.23 (44)	0.0044 (at 900° C) (15) 0.00432 ± 0.00015 (15)			Good			
Porcelain (Bonded)	Fair		2.24 to 2.35	0.0045 (100° C) (85)	3.3×10^8 (at 1000° C) (71)	6-7	Good	20-200° C 20-400° C 0.202 0.221 (86)	0.5 (500° C)	
Magnesia (Granular)			3.67-3.69 (44) β MgO 3.2 α MgO (83)	0.00047 (powdered) (0-100° C) (79)		5		0.2385 (25° C) (51) -135° C 39° C 61° C 0.1006 0.1933 0.2520 287° C 390° C 0.267 276 (54) (55) 0.355 (20-2780° C) (89)	0.09 (500° C)	1.66 (88) (Periclase)
Magnesia (Bonded)	Very poor (brick) (24)	2.60-2.75 2.27 (16)	3.44-3.60 (brick)	0.00652 ± 0.00012 (14) 0.0071 (at 1000° C) (22) (brick) 0.0085 (at 1000° C) (34) (brick) 0.0080 (at 1000° C) (35) (brick)	6200 (1300° C) (brick) (32) 420 (1400° C) (brick) (32) 55 (1500° C) (brick) (32) 30 (1550° C) (brick) (32) 25 (1565° C)		Very Poor (brick) (25)	0.22 (brick) 200° C 400° C 600° C 0.253 0.275 0.290 800° C 1000° C 0.316 0.324 0.340 (1200° C) 0.349 (1300° C) (56)		
Spinel (Granular)			5.37 (88)			8-9		0.194 (15-47° C) (64)		1.7155 (88)
Spinel (Bonded)	Good						Good			
Silica (Granular)			2.20-2.65 (93)	0.00060 (20-100° C) (sand) (79)		7		0.1867-0.2640 (0-1100° C) Quartz (90) 0.1882-0.2679 (0-1400° C) Crystobalite (90)		
Silica (Fused and bonded)	Excellent	2.22 transparent 2.07 translucent			5×10^{18} (78) (20° C) 4×10^6 (727° C) (88)		Good			
Carbon (Amorphous) (Bonded)	Excellent		1.7-2.0 (88)	360°C 750°C 942°C 1400° C 2000° C 0.090 0.124 0.130 0.137 0.145 (37) Granular 0.00040 (20-100° C) (79)	20° C 360° C 750° C 1400° C 2000° C 0.0046 0.0042 0.0038 0.0037 0.0036 (37) Granular 0.0069-0.0049 (0° C) L.B. Tabellen Granular 0.00403 (0° C) L. B. Tabellen		Good	0.2040 (24-68° C) 0.3145 (20-1040) (67) 0.381 (1297° C) (88)		Opaque
Graphite (Bonded)	Excellent	1.79	2.17-2.32 (88)	390° C 546° C 720° C 1400° C 2000° C 0.337 0.326 0.292 0.277 0.254 (37)	20° C 390° C 546° C 720° C 0.00085 0.00084 0.00982 0.00080 1400° C 2000° C 0.00079 0.00079 (37)	0.5-1.0	Poor	0.467 (977° C) 0.310 (19-1040° C) (67) 0.475 (0-2000° C) (68) 0.535 (0-3000° C) (68) 0.160 (11° C) 0.254 (1380° C)	0.95 (500° C)	Opaque
Silicon Carbide (Granular)			3.12-3.20 (20)	0.00050 (20-100° C) fine 0.00051 (20-100° C) coarse 0.0093 (600° C) (88)		9-10		0° C 300° C 0.140 0.261 600° C 900° C 0.275 0.185 (88)		$N_{a\omega}$ = 2.654 $N_{a\epsilon}$ = 2.697 (14) ω = 2.786 ε = 2.832 (88)

(Bonded)	Fair (used)	2.42-2.48 (16)		0.0235 (15) 0.024 (at 750° C)	107 refrax) recryst. 4-5 2.45 1.82 107,200 12,550 4,160 745 (Carbo-B) clay bond 127 × 10⁶ 835,000 29,150 8,590 (Carbofrax C)					
Zirconia (Granular)			5.8 (fused) (88) 4.75	0.00039 (79)		6.5		0.1076 (0-100° C) (70)	0.09 (500° C)	
Zirconia (Bonded)	Fair (brick) (24)	3.3 (16)		Low (brick) (36)	1200° C 1400° C 1250 300 (29)		Good (brick) (25)	25-600 25-1000 0.137 0.157 25-1200 25-1400 0.167 0.175 (80)		
Zircon (Granular)			4.5-4.6 (88)					0.132 (21°-51° C) (69) 0.146 (15-100) (Regnault)		ε = 1.9682 (73) ω = 1.9239 (88)
Zircon (Bonded)	Good			0.0025-0.0067 (1130° C) (brick)	1232 (at 1200° C) (71)		Good (25)			
Chromite (Granular)			4.3-4.5			5.5		0.174	0.99 (1000°C)	2.097 (88)
Chromite (Bonded)	Very poor (24) (brick)	2.83 (16) 3.0-3.2	3.9-4.0 (brick)	0.0034 (brick) (22)	800° C 900° C 1000° C 1200° C 1400° C 2800 760 420 450 410 320 (at 1400° C) (32)		Fair (25)	0.199		
Fireclay (Bonded) (Brick)	Good (best ware)	1.8 to 2.05	2.62-2.75 (brick)	Granular 0.00028 (20-100° C) (79) 0.00169 (100° C) 0.00339 (1000° C) (39) 0.0034 (at 1000° C) (66) 0.0042 (at 1000° C) (22) 0.0040 (34) } Brick	600° C 800° C 1000° C 1200° C 21,000 12,000 6,600 2,300 1400° C 1550° C 690 60 (32)	6-7	Good (25)	25-600 25-1000 0.228 0.265 25-1200 25-1400 0.284 0.297 (80)	0.79 (400° C) (97)	
Silica Brick	Very poor below red heat. Excellent above red heat (82)	1.55-1.92	2.30-2.50	200° C 1000° C 1370° C 0.0026 0.00426 0.0050 (66)	20° C 800° C 1200° C 1500° C 125 × 10⁶ 2.38 × 10⁶ 62,000 8,420 (26)	7	Good	25-600° C 25-1000° C 0.227 0.263 25-100° C 25-1400° C 0.282 0.294 (80)		
Highly aluminous refractories (Diaspor)	Good; average 9% in 10 dips (reheated brick) (96)	1.91			20° C. 800° C. 1200° C. 137×10⁶ 5 × 10⁶ 193,000 1500°C. 2500 (26)		Good			

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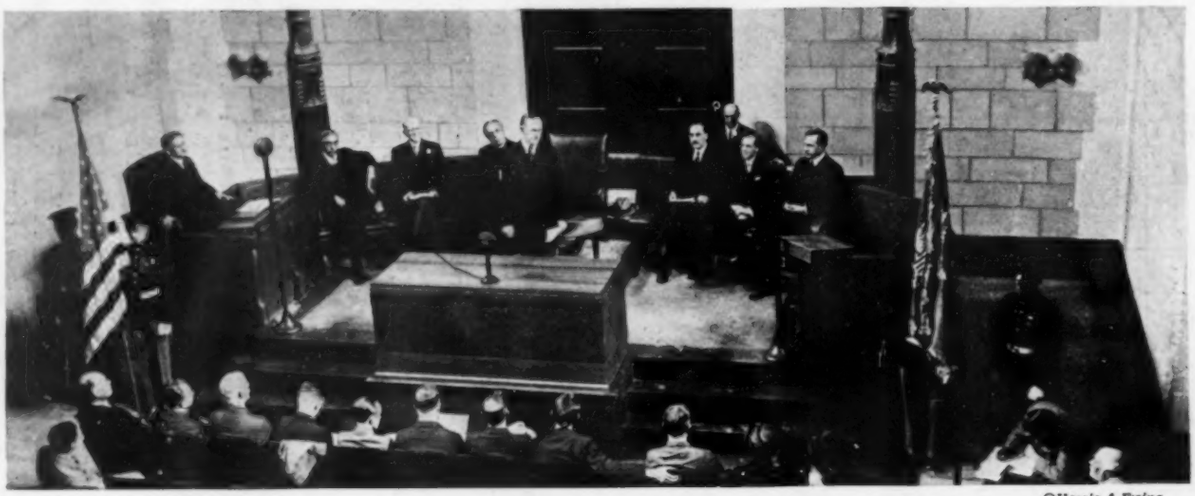

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President Coolidge Speaking at Dedication of New Building of National Academy of Sciences

The platform group, from left to right, is: A. A. Michelson, president of the Academy; C. Bascom Slemp, secretary to President Coolidge; Charles D. Walcott, secretary of the Academy; James E. Freeman, Bishop of Washington; the President; John C. Merriam, president of the Carnegie Institution; Vernon Kellogg, secretary of the National Research Council; Gano Dunn, chairman building committee, National Research Council.

"Science—Pilot of Industry"

The Magnificent Home of the National Academy of Sciences and the National Research Council Dedicated to the Amelioration of Humanity Through the Power of Scientific Research

IN the stern days of the Civil War Congress created the National Academy of Sciences partly with the idea of strengthening the national defense, but primarily to advance knowledge so that it would benefit the nation. This limitless task was begun and carried on by the brilliant individual work of the many distinguished members of the Academy and their colleagues. Then came the World War and the President of the United States called on the National Academy of Sciences to aid the nation in its emergency. This led to the establishment by the Academy of the National Research Council under the same charter. Such marvels in the co-ordination of research were accomplished and such obvious benefits accrued from the work of this body that the President asked for its continuance.

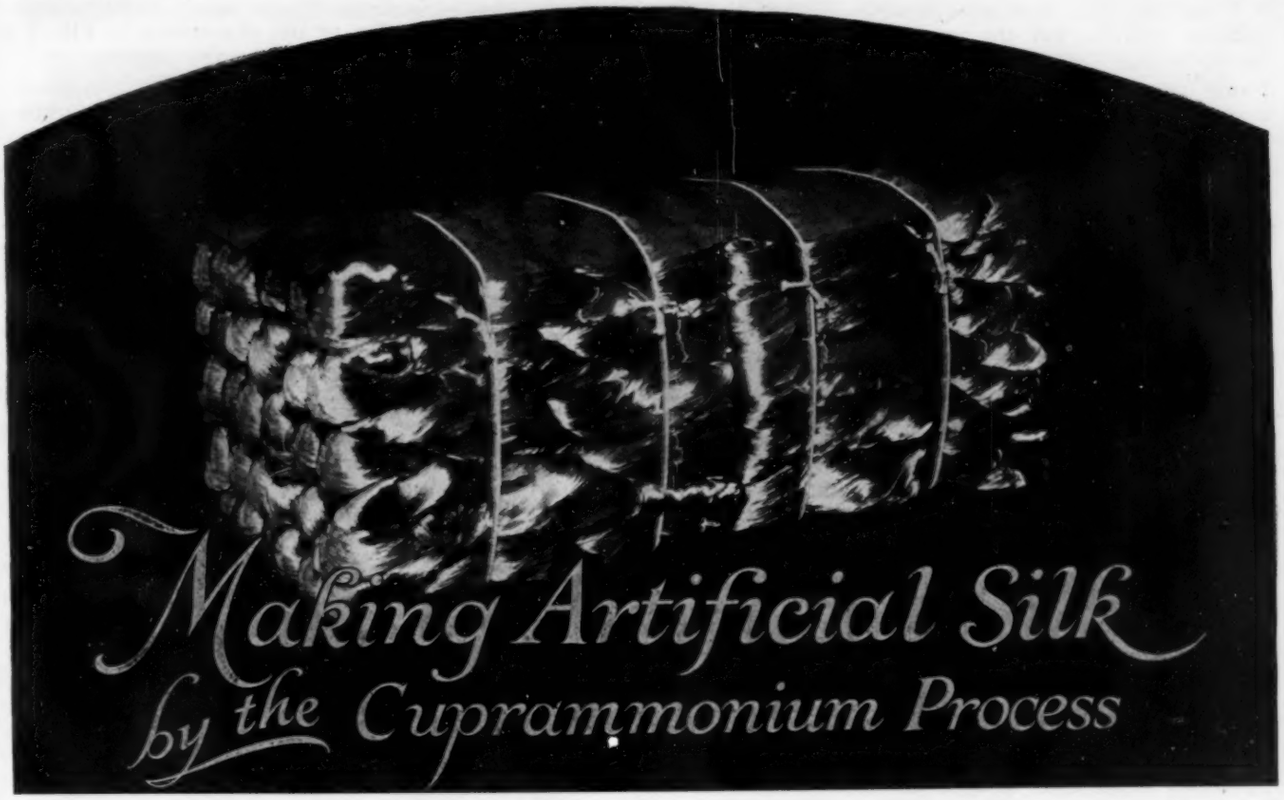
It was peculiarly appropriate that the Carnegie Foundation should have made possible a permanent home in Washington for these two great organizations. It is appropriate, for they represent in full measure one of Andrew Carnegie's ideals—the harnessing of Science to lift the burdens and improve the condition of all the people of the United States.

The ceremony of turning over this beautiful building to the Academy took place on April 28 in the presence of a distinguished gathering. The building is both a workshop and a temple. Here the visitor will find some of the marvelous discoveries of science in actual demonstration. Here, where the great diversity of work undertaken by the National Research Council is carried out, will be found exhibits of ancient and modern scientific advance. The first experiments of Faraday, upon which are based our use of electricity, stand beside the latest developments in radio. Michelson's interferometer, the Foucault pendulum, a Wilson - Shimizu apparatus for observing the tracks and collisions of atoms and scores of other exhibits, which will be changed from time to time and brought up to date, should serve as an inspiration for the visitor and a spur to the scientist.

Here in this temple, for it is more than a building, will burn the fire of "Science—Pilot of Industry, Conqueror of Disease, Multiplier of the Harvest, Explorer of the Universe, Revealer of Nature's Laws and Eternal Guide to Truth."

Here may there be born a spirit that will spread abroad the true beneficence of science. It is unfortunately believed by many that science is responsible for machines of war and destruction and that science will be man's ultimate destroyer. The looseness of thought and tongue that have been responsible for this must have effective counteraction. From such sources as these great agencies and this building must come the controversion. It will be part accomplished if the people of the country come and see the building and its great exhibits. It will be part accomplished by the teachers in school and college, if only they can give some of the thrill, the beauty, the romance of science and even some of its best utility instead of a mere catalog of facts in an obscure language.

The greatest task ahead is not the undertaking and the accomplishing of scientific work now that we have the guarantee of the National Research Council but the insuring of sympathetic understanding by the people.



Making Artificial Silk by the Cuprammonium Process

Although Successfully Applied in Europe, This Method Has Met with Many Reverses in This Country Due Largely to Lack of Knowledge of Its Fundamental Chemical Engineering

By L. S. Fryer
Chemical Engineer, New York City

EDITOR'S NOTE. One of the interesting things about an industry as new, comparatively speaking, as the manufacture of artificial silk is the extent to which it relies upon methods and equipment developed in other industries. For instance, in the cuprammonium process here described we see the purification and bleaching of the cotton linters according to the established methods of the nitrocellulose industry, the driers first developed in the textile mills, centrifugal clarification, filter pressing and similar chemical engineering operations of more or less standardized character.

A word regarding the economic status of the artificial silk industry is perhaps in order. Since its very beginning the industry has had startling growth. In 1913 the United States produced 1,570,000 lb. Ten years later the estimated output was 33,500,000 lb.—an increase of more than 2,000 per cent!

OF THE four processes for the manufacture of artificial silk in use in the United States—the Chardonnet or nitrocellulose, the Pauly or cuprammonium, the Cross and Bevan or viscose, and the cellulose-acetate—the viscose process has completely outdistanced the others in production and the cuprammonium process has met with the greatest reverses. The reason for the apparent failure of the Pauly process is primarily a lack of knowledge of the fundamental chemistry of the process as well as the chemical engineering required for its successful application. At the present time further efforts are being made to produce cuprammonium silk in this country, but the ultimate success of these efforts is still in doubt. It will be the purpose of this article briefly to review the manufacture of artificial silk by the cuprammonium process and to point out important factors on which successful production is dependent.

In 1890, Despeisses (Fr. Pat. 203741) invented a process employing ammoniacal copper hydroxide as a

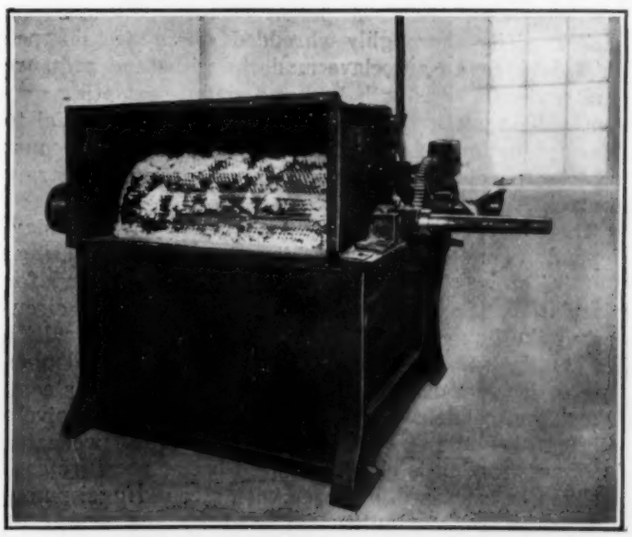


Fig. 1—Rag Picker Used in Shredding the Bales of Raw Cotton Linters

cellulose solvent, but the premature death of the inventor left the patent uncompleted. By 1897, however, Pauly had worked out the details and had begun large-scale operations. To date, a great many patents on modifications of this process have been taken out, but in general all include the following basic steps: Scoured and bleached cotton cellulose is dissolved in a solution of ammoniacal copper hydroxide; this solution is projected through capillary openings into a coagulating bath containing either acids or alkali, whence the threads are drawn out, washed and dried. Twisting, spooling and reeling operations are then necessary before the fiber can be marketed for conversion into fabrics.

Beginning With the Cotton Linters

The starting material is, in general, raw cotton linters. Although wood cellulose might be employed successfully in the process, experience has shown cotton cellulose to be the most advantageous material for use on an industrial scale. The linters are the short-stapled fibers clinging to the seed after the bulk of the longer fibers have been removed to be used directly in cotton fabrics. The artificial silk producer receives the raw cotton linters contaminated with the natural constituents, non-cellulosic substances as pectins, resins, nitrogenous bodies and various mineral substances. Analysis shows the linters to contain about 7 per cent moisture, 7 per cent foreign materials and about 86 per cent pure cellulose, although these vary for cotton from different sources. In most cases, cotton has a considerably higher percentage of pure or α cellulose than wood, a factor that is important from the standpoint of economy and quality of the finished thread. Before the cotton is available for solution in ammoniacal copper hydroxide, it must be freed from all impurities. The waxes, fats, etc., are removed by boiling in lye under pressure and the coloring matter, together with the residual dirt, is oxidized by subsequent bleaching.

The Kiering Process

Before scouring, the highly compressed bales of linters as they arrive at the plant are shredded in a standard rag-picker such as shown in Fig. 1. A separate metal- or brick-lined building should house this operation, because of the fire and explosion hazard resulting from the development of cotton dust by the picker. The thoroughly shredded fibers are dumped into the kier, an autoclave made to withstand pressure and equipped with both lye- and water-circulating systems. The proper boiling-out apparatus is essential to the production of a satisfactory product and must possess the elements of steady operation and accurate control.

There are two general types of kiers in use today, depending on the method of heating and circulating: (1) injector; (2) closed-coil preheater with pump for circulation. Some special types use vacuum for circulating the liquor. The injector presents no difficulties in circulation, but introduces an element of danger due to local overheating of the fiber with live steam. Then, too, condensation of the steam may excessively dilute the boil liquor. With the closed-coil preheater local overheating is eliminated and better pressure control can be exercised, but even with a centrifugal pump, circulation is constantlty impeded by the action of boiling caustic soda on the pump packing. However, the second type similar to the one shown in Fig. 2 is generally regarded the better for the purpose.

The factors to be controlled in kiering are concentration of caustic soda or soda ash solution, temperature or pressure, and time of boil. These conditions vary with the quality of the cotton. If the treatment is too intense, the alkali, especially if air is present, rapidly disintegrates the fiber and attacks the cellulose itself, forming degraded cellulose products, which lower the quality of the thread. The crux of the operation, then, is to regulate the conditions to give maximum purification of the cotton and minimum tendering of the fiber. It might be mentioned here that small amounts of soap or soluble oils such as turkey-red oil are efficient additions to the boil.

Immediately after scouring, the boil-liquor is drained off and the cotton is thoroughly washed with hot water. Careful attention should be given to the quality of the wash water, since the presence of sulphates and bicarbonates of calcium, magnesium and iron interferes with subsequent solution and has a deleterious effect on the luster and dyeing properties of the silk. The cotton is drained, whizzed in a centrifugal wringer, and dumped into the bleach tank.

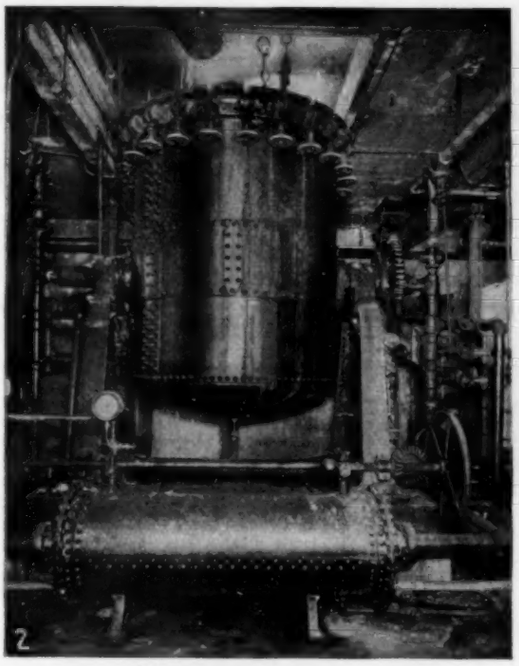
Hypochlorite Bleaching

The cotton, after boiling, has a straw-yellow color, which is removed by bleaching. Sodium hypochlorite, the most suitable bleaching agent for this purpose, is generally prepared in the plant directly before being used. A tall concrete or stoneware tower is filled with the caustic soda solution and chlorine gas is bubbled in from the containing cylinder through a lead diffuser that extends to the bottom of the tower. The quantities of caustic soda and chlorine should be in stoichiometric proportions, allowing a slight excess of alkali in order to keep the solution stable. This concentrated bleach solution is diluted to the desired content of available chlorine in a large tank, from which the diluted liquor is circulated through the cotton. Thorough circulation and frequent agitation to avoid channeling are necessary for the best results.

The bleaching action depends on the strength of the liquor, the temperature and the time. Many bleachers have elected to increase the temperature with a view to shortening the time required and decreasing the amount of chemicals. Such a procedure, however, is hazardous, especially in this instance, for not only is the coloring matter oxidized during the bleaching operation but the cellulose is also attacked. Raising the temperature facilitates the breaking down of the cellulose into oxycellulose, which is detrimental to the properties of the silk thread, materially reducing its tensile strength and injuring its luster. Here, again, care must be exercised in bleaching the cotton to pure whiteness without weakening the fiber.

The bleached cotton is now washed well with water. Acid scouring is unnecessary in the cuprammonium process. It is sufficient to add an antichlor such as sodium bisulphite or sodium thiosulphate to the wash water, to neutralize the chlorine. After draining and centrifuging, the white cotton cellulose is dried in a steam drier of the conveyor type (see Fig. 3), with accurate and automatic temperature control. The temperature must not go too high, as bleached cotton is more susceptible to charring than are the raw linters.

Many patents have been taken out on methods of making up the cuprammonium solution with a view to



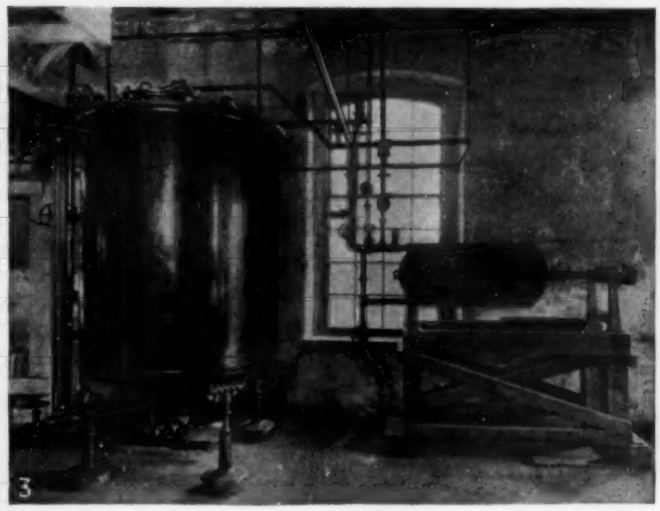


Fig. 2—Kier With Preheater for Boiling Out the Cotton Linters With Caustic Soda.

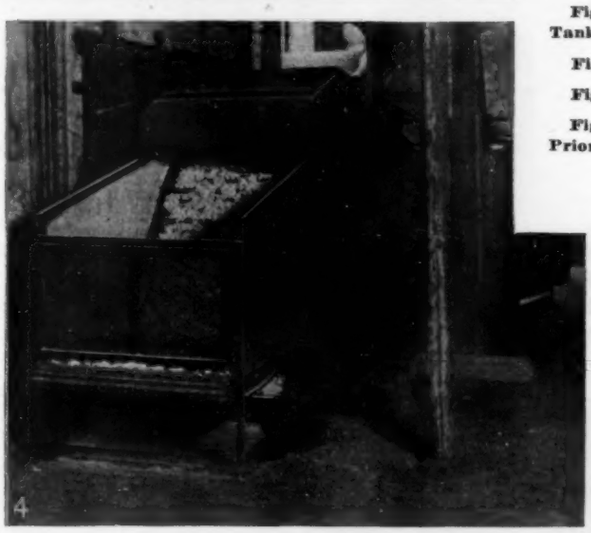
Fig. 3—Steam Drier, Conveyor Type, for Bleached Cotton.

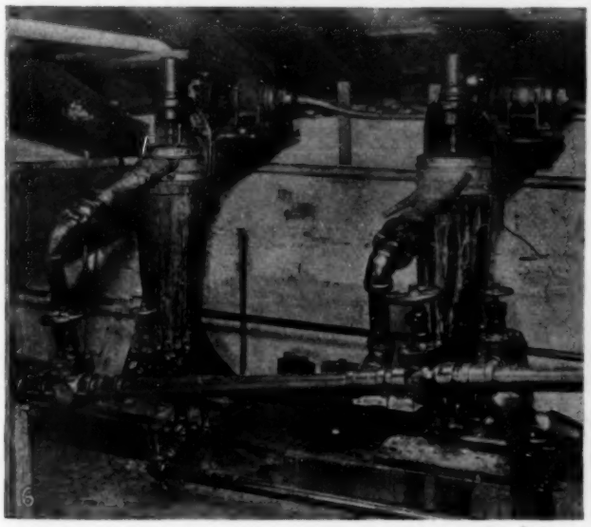
Fig. 4—Solution Room, Showing Mixer, Steam Pump and Dump Tanks.

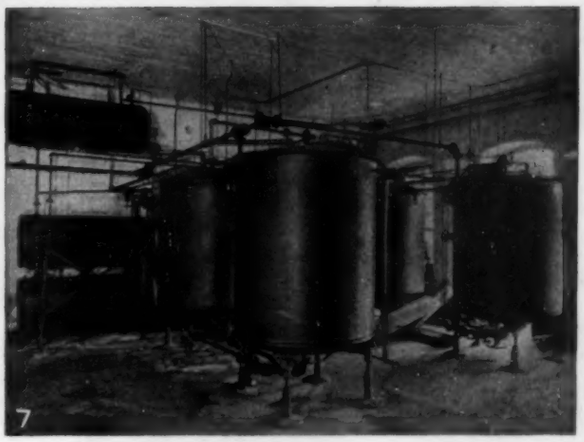
Fig. 5—Filter Press and Receiving Tank.

Fig. 6—Supercentrifuge for Final Clarification.

Fig. 7—Battery of Glass-Lined Storage Tanks Holding Solution Prior to Spinning.







making a more stable solution, to increase the solubility of the cellulose, and to produce a thread of certain desirable properties. The fundamental principle in all of these patents is to utilize the property of the so-called Schweitzer's reagent, generally designated as $Cu(OH)_2 2NH_3$ to dissolve cellulose. When cotton is immersed in the copper-ammonia solvent, the fiber undergoes swelling, disintegration and gradual degradation of the cellulose aggregate until a homogeneous colloidal solution is obtained. The viscosity of the resulting cellulose solution depends on a great number of factors, including the intensity of the boiling and bleach treatments, presence of light and air, temperature, length of time the materials are stored before solution, age of solution, etc. In plant operation all of these conditions must be standardized and accurately controlled to give a uniform product.

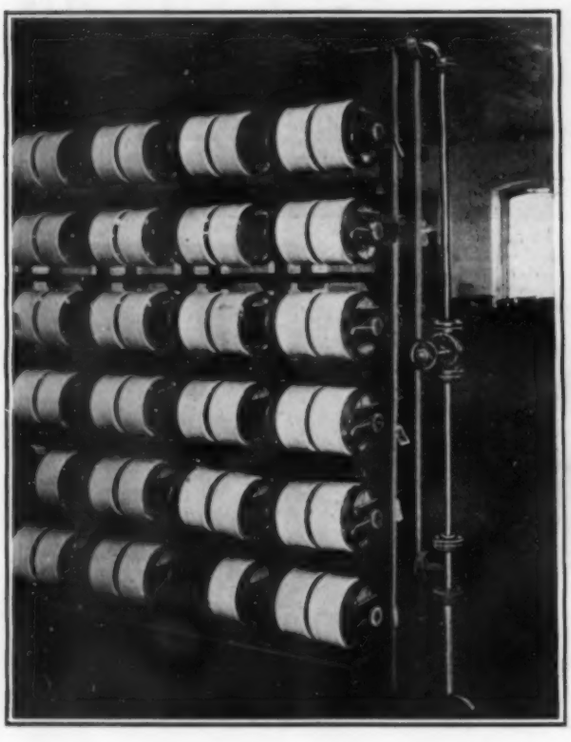
Schweitzer's reagent may be made up, according to the early method, by bubbling air through copper turnings submerged in ammonia. The copper is oxidized and gradually goes into solution in the ammonia, giving a deep blue liquor. When cellulose is dissolved in this solution, a low temperature must be maintained in order to keep it from decomposing. Decomposition of the cellulose is evidenced by increased liquefaction or lowering of viscosity. Another method involves the precipitation of copper hydroxide directly in the cotton fiber, and the solution of this mixture in ammonia. A more easily controlled method and one that gives a stable solution at ordinary temperatures consists in preparing the copper hydroxide separately and then mixing all three materials—cellulose, ammonia and copper hydroxide—until the desired viscosity is attained. Such a solution may stand for considerable time without noticeable change. The addition of small amounts of caustic soda, glucose and glycerine is claimed by some to improve the stability and spinning properties of the solution.

The mixing machine has two oppositely rotating knife impellers that completely disintegrate the cotton fiber and thoroughly agitate the solution. Every hour a sample is taken for a viscosity determination until the desired fluidity is reached, at which time the mixer is stopped. The solution is forced from the mixer through a strainer into dump tanks by means of a steam-driven double-acting piston pump. The strainer removes any clods of undigested cotton or copper hydroxide. From the dump tanks, the solution is forced under air pressure through a filter press, where foreign particles are taken out. A final clarification is made by means of super-centrifugal separators, after which the solution is ready for spinning. Equipment for these operations will be observed in Figs. 4, 5 and 6.

Spinning Operations

Spinning, as its name implies, consists in converting the solution into threads. The solution arrives at the spinning machines under pressure and is forced through tiny openings in the "spinneret-heads" or "jets" by means of a small pump at each jet. These jets are submerged in the precipitating bath, so that as soon as the solution comes in contact with the coagulating agents, filaments are instantly formed, which are taken up and wound on a rotating glass drum. The use of the pumps at each jet insures steady, uniform flow and consequently a uniform thread.

In practice, the cuprammonium solution of cellulose is spun in acids, bases and salts. Sulphuric acid is the usual coagulating acid in the bath. It has the advantage over hydrochloric in that there are no fumes to contend with. Ammonium sulphate and copper sulphate are formed and the cellulose is precipitated as a filament. Weak sulphuric acid does not react with sufficient rapidity to give a workable thread. Concentrations of the acid ranging from 35 to 60 per cent have been used successfully. However, by increasing the strength of the acid, the danger of breaking down the cellulose is increased. In fact, cellulose may be



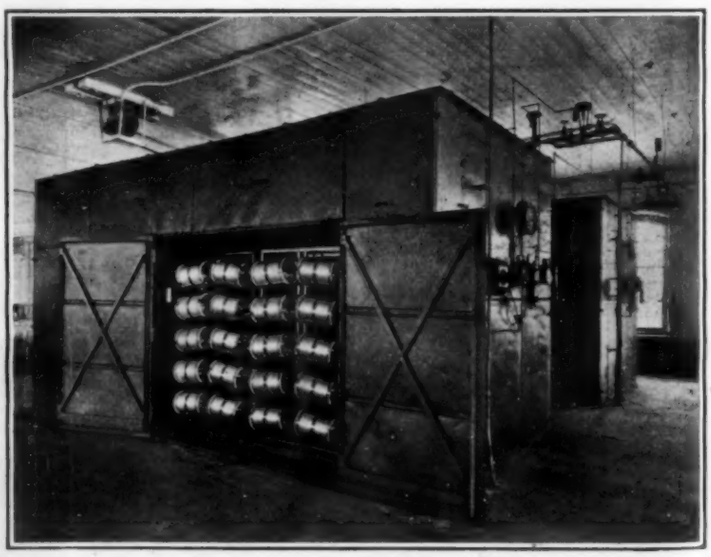


Fig. 8 (at left)—A Section of the Wash-Racks, Showing Glass Cylinders Covered With Fiber as It Comes From the Spinning Machines.

Fig. 9 (above)—Drier, Showing Truck Loaded With Drums of Silk.

dissolved completely in 72 per cent sulphuric acid. With any concentration, this hydrolysis goes on to a more or less extent, the ultimate product being glucose. As a result, the finished thread may be weakened and made brittle.

Caustic soda, as a coagulating agent, has been found to give a more tenacious thread. It acts quite differently from sulphuric acid, because it precipitates both the copper and the cellulose by liberating the ammonia. The copper hydroxide must be removed from the thread by subsequent washing with acid. A concentration of 30 per cent caustic soda may be used advantageously. A good exhaust system is necessary to remove the ammonia fumes.

The presence of salts in the bath helps coagulation

Fig. 10—Combination Spooling and Twisting Machine
The silk comes from the drier wound on large glass bobbins. Before it is twisted into thread it is usually rewound on small spools. The machine shown here combines these two operations.

because as electrolytes and dehydrating agents they increase the osmotic pressure of the bath. Glucose is added because of its extremely high osmotic pressure. The properties of the thread, such as tensile strength, elasticity, suppleness and affinity for dyes, vary in a specific way with the conditions in the bath, including temperature, composition of the bath, distance that the thread travels, rate of flow of bath, etc. All of these factors must be kept within very narrow limits if a uniform product is to be produced.

When the filaments emerge from the bath, they are wound on cylinders or bobbins. The spinnerets may have any number of openings depending on the number of filaments required to make up the thread. In general, the coarser the thread the more filament openings in the spinneret. The filaments of each spinneret are wound together, the drums bringing the threads in contact with very dilute acid in order to remove the remaining copper not dissolved by the precipitating bath. When the cylinders have received their yardage, which is measured by a determined time interval, men, called "doffers" or "bobbin floppers," replace the filled drums with empty ones. If the winding cylinders are made to rotate by friction, they should be made as perfect as possible and the driving mechanism should be accurately primed to avoid bouncing and irregular winding. If rotation is effected by direct gear drive, care must be taken in meshing the bobbins into place, because a jam may cause the shut-down of an entire machine. In many plants doffing is done automatically, a practice that also has its good and bad features.

The acid-soaked bobbins of silk, as they come from the spinning machines, are placed on the wash racks, shown in Fig. 8, where soft water is trickled on the silk until it is neutral to methyl orange. Many different devices have been tried in washing the silk to cut down the time and amount of handling, but none has been found as efficient as the trickle system. The time necessary for complete removal of the acid depends on the thickness of the "cake" of silk, the nature of the winding, the flow of water and the conditions of the filaments—that is, whether they are gelatinous, compact, etc. In general, acid-coagulated cuprammonium silk is gelatinous as it comes from the spinning machines and must be handled on the wash racks with great care, for the slightest touch will ruin the silk. Owing to the gelatinous nature of the silk, the filaments, after drying, stick together and are very difficult to unwind from the bobbins. Conditions in the spinning bath have considerable to do with the nature of the silk. Soap, glycerine or sulphonated oil may be added to the wash water to facilitate unwinding.

The thoroughly washed bobbins are now put into the

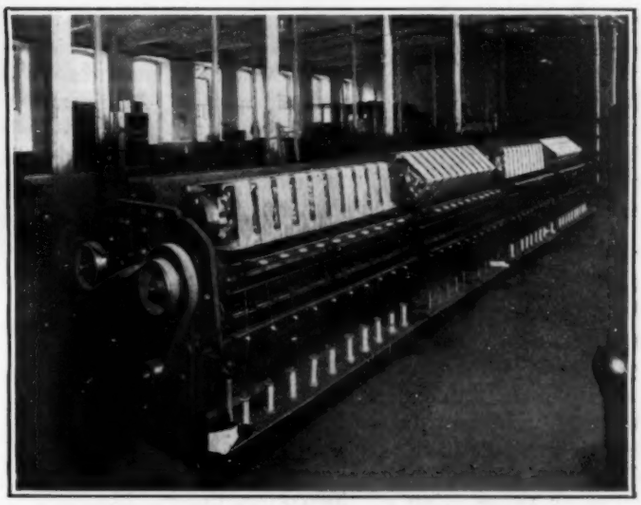


Fig. 11—Reeling Machines
Here the twisted silk thread is taken from the small spools and reeled into skeins each of exactly the same yardage. This is automatically controlled by this ingenious machine.

drier. As the silk dries it acquires a luster, the intensity of which depends on the temperature, the tension applied to the threads and the nature of the cellulose solution from which the silk is spun. As the water evaporates the thread contracts, becoming tighter and tighter, around the bobbin. This increasing tension pulls the thread into a uniform structure that reflects light in such a way as to produce the effect of the silky gloss. The higher the temperature the greater the luster, but drying at high temperature produces a weak, brittle thread. It is advisable to dry the silk slowly in a humid atmosphere, so that any structural changes in the fiber may go on gradually and uniformly.

At this point the silk is considered having passed the chemical stages and now enters the textile operations. The filaments on the bobbins are wound parallel, and in this state cannot be knitted into fabrics, because they are too easily separated and broken. For this reason the filaments are twisted spirally around one another, making a composite thread out of many indi-

vidual strands. The number of "twists" or "turns" per inch of thread depends on the kind of fabric for which the silk is intended, but in general two to three turns per inch are given to the thread. If the silk is twisted and reeled immediately after coming from the drier, the skein tends to curl up with a loosening of the twist, which makes subsequent winding extremely difficult. In order that the twist may be permanent and to facilitate unwinding from the bobbins, the silk coming from the driers is permitted to absorb moisture for several hours. This is done by allowing the bobbins to stand in a humidity-controlled room. In fact, it is essential that the part of the plant in which the textile operations are carried on should be carefully controlled for temperature and humidity.

The thread is usually unwound from the bobbins and wound on small spools before twisting, although some plants combine the spooling and twisting operations, using a machine such as is shown in Fig. 10. The spools of twisted thread are now placed in the reeling machine (Fig. 11), where the silk is wound on a "flyer" into skeins. The skeins are all exactly the same length, the machine being regulated to stop automatically at the correct yardage. If one strand happens to break during the reeling, the entire machine stops and the operator ties up the broken ends and then continues the reeling. The threads are guided on the flyer in a criss-cross fashion by a traverse bar which moves laterally to and fro as in simple harmonic motion. While still on the flyer, the skeins are laced by passing a cotton thread through the openings made by the criss-crossings. Three lacings are usually made at regular intervals in the skein to prevent tangling of the threads.

Properties of the Finished Product

If cuprammonium silk is made properly, the skeins need no bleaching. Sometimes the silk appears bluish due to traces of residual copper that cannot be removed by bleaching. Even acid treatment is rarely effective, because too strenuous treatment attacks the silk and too mild treatment fails to remove the copper. Electrolytic methods have been suggested, but these are not always practical. If the skeins are not white, due to improper preparation of the cotton linters, bleaching will, of course, oxidize the organic impurities in the silk threads.

To obtain most economy in the production of cuprammonium silk, every plant has the problem of reclaiming the copper and ammonia that has gone into the spinning bath from the cellulose solution. In the manufacture of copper hydroxide the waste liquor is saturated with ammonia, which may be recovered by distillation. If caustic soda is used as the coagulating medium in the spinning bath, a good exhaust system will recover the ammonia fumes liberated from the cellulose solution. The copper in the weakened spinning bath is generally precipitated as the pure metal by the immersion of bars or sheets of iron. The supernatant liquor is concentrated in a lead-lined vacuum evaporator and allowed to crystallize in large open pans. As the mother liquor drained from the crystals contains considerable sulphuric acid, it is used again in the spinning bath. The crystals of ammonium sulphate and iron sulphate are dissolved in water, slaked lime is added, and the liberated ammonia is distilled over for re-use. The maintenance of an efficient recovery unit is a difficult proposition, but more than pays for itself.

At the present writing, no plant in this country has been able to produce silk by the cuprammonium process at a profit. The silk that has come from abroad shows remarkable dyeing properties, being able to dye to the faintest shade and to take the dye very easily. It has an uncommonly brilliant luster, which has given it the occasional name of "glanzstoff."

The cuprammonium process, perhaps more than any other, requires a thorough knowledge of chemistry and engineering. Colloid chemistry plays an important rôle in the production of a thread that is pliable, soft, strong, elastic and easily dyed. Cellulose from which artificial silk is made has by no means been fully investigated. In fact, many of the problems of the industry arise from a poor understanding of this complex substance and its properties.

Artificial silk is not an imitation of natural silk, as is commonly supposed. It is a distinctly new fiber with characteristic properties. The effects that can be produced with artificial silk cannot be made with any other fiber. It is a chemical engineering product that is here to stay.

Domestic Magnesite Producers More Active

The Department of the Interior announces through the Geological Survey that statistics compiled by J. M. Hill show that the magnesite material marketed in the United States in 1923 from domestic mines was equivalent to 147,250 short tons of crude magnesite, valued at $1,103,700, an increase of 164 per cent in quantity and 93 per cent in value as compared with the quantity marketed in 1922. As the value is based on the price of crude magnesite f.o.b. mines and is about 50 per cent of the output—a much larger percentage than usual—was made in the State of Washington, where the operators place a low value on the crude uncalcined rock, the increase in value in 1923 was low as compared with the increase in quantity.

The reports of the Bureau of Foreign and Domestic Commerce show that the magnesite material imported for domestic consumption in 1923 amounted to 5,182 short tons of crude magnesite, valued at $44,081; 10,928 tons of caustic calcined magnesite, valued at $306,610; and 61,726 tons of dead-burned magnesite, valued at $707,383.

These figures would appear to indicate that the foreign producers can mine and calcine magnesite more cheaply than the domestic producers. No crude or calcined magnesite was exported.

Magnesite (Expressed as Crude) Consumed in the United States, 1918-1923, in Short Tons

Year	Domestic Production	Imports	Apparent Total Consumption	Proportion of Consumption Supplied by Domestic	Foreign
1918	231,605	43,530	275,135	84	16
1919	156,226	25,321	181,547	86	14
1920	303,767	63,110	366,877	83	17
1921	47,904	65,569	113,473	42	58
1922	55,790	217,861	273,651	26	74
1923	147,250	150,490	340,829	43	57

The table shows that the domestic producers regained in 1923 some of the market they lost in 1922, largely, probably, because of the protection afforded by the new tariff act. Operators report, however, that even with the present tariff it is almost impossible to compete with either dead-burned or caustic foreign magnesite in the Eastern markets on account of the great cost of production and high freight rates.

Nitrogen From Coal

How Much Ammonia Will Be Produced From Coal and What Will It Sell For Are the Questions Answered in This Part of the Fixed Nitrogen Report

By Harry A. Curtis

Special Agent, Bureau of Foreign and Domestic Commerce, and Professor of Chemical Engineering, Yale University

THE principal domestic source of fixed nitrogen in the United States has for years been the coal-processing industries. In these industries ammonia is one of the byproducts of the manufacture of gas and coke, which are the principal or primary products. The ammonia is formed by reactions incident to the destructive distillation of the coal and comes out of the gas retort or coke oven with the other constituents of the crude gas. It has usually been regarded as an optional matter whether this ammonia should be recovered from the gas and marketed, or washed from the gas and thrown away, or left in the crude gas that is used for fuel. In recent years, however, economic factors have tended to make recovery and sale almost an inevitable part of the operation of all byproduct coke ovens and of nearly all large coal-gas plants.

It was not long ago that steel makers were invited to try out a new kind of coke. Instantly there was an outcry. "Not nearly so good! Not the right color! Not the right structure!" and so on. But the new coke was byproduct coke, and it has finally won its battle. As a result of the victory a tremendous source of fixed nitrogen has been opened to the world. Nitrogen from coal comes on the market as sulphate of ammonia and is one of the major factors considered by Dr. Curtis in the Fixed Nitrogen Survey.

The production of ammonia from coal comes principally in connection with the ordinary coke and coal-gas industries as indicated above. Very small quantities are produced as yet by the newer process of distilling coal at relatively low temperatures, but in the future this source will no doubt become increasingly important.

In order to give a complete picture of the production and distribution of ammonia and its salts in the United States, brief mention must be made of the small amounts produced by distillation of shale, bone, etc., and of the amounts exported and imported. The amounts produced in shale distillation are, like those from low-temperature carbonization of coal, very small at present, but likely to become of increasing importance in the future. The distillation of bones produces a few hundred tons of sulphate equivalent per year, but the amount is likely to grow less rather than greater. For our present study we have taken the ammonia produced by all these incidental sources as 1,000 tons of ammonium sulphate equivalent per year.

There must also be included the amount of ammonia now produced from the nitrogen of the air. At present this is practically limited to the output of the Atmospheric Nitrogen Corporation's plant at Syracuse, N. Y. This plant has not been in steady operation, being somewhat of an experimental plant, and the company has not made public any production data. For statistical purposes we have taken the production at a daily capacity of 12 tons of ammonia. This would be equivalent to about 17,000 tons of ammonium sulphate per year.

In Table I there is set up a summary of the total ammonia nitrogen available in the United States from various sources, expressed for convenience in terms of nitrogen equivalent.

Ammonia nitrogen is used in the making of mixed fertilizers; as a fertilizer applied directly to the soil; for the manufacture of anhydrous ammonia, aqua ammonia, and ammonium salts; and a considerable quantity is exported as ammonium sulphate. The approximate amounts used in these various ways are indicated in Table II.

Some idea of the probable future production of ammonia nitrogen can be had from the present trends in the industry. But any forecast involves certain difficulties, particularly at the present time, when many new factors enter to affect the situation. Such forecast is, of course, at best only an approximation or guess based upon conditions of the recent past judged in the light of the business tendencies of today. The maximum period for which any forecast is believed to be significant is about 10 years. Therefore, with a clear recognition of the limitations of such forecast, an estimate of the probable ammonia nitrogen production in 1933 has been made.

It is believed that the principal domestic sources of ammonia nitrogen will continue, as in the past, to be the ammonia liquors and ammonium sulphate made at gas works and coke ovens for at least the 10-year period under consideration. The real problem in forecasting is, therefore, the estimation of the probable increases in the quantity of coal that will be treated at such plants. This in turn will be determined principally by the demand for coke for manufacture of pig iron. However, in the future there will probably be increasing importance attached to the production of coke as domestic fuel to substitute for anthracite and the treatment of coal in coke ovens or vertical retorts for the manufacture of gas for city supply.

Increases in byproduct coke production for blast-furnace use will result from two factors: First, the substitution of byproduct ovens for beehive ovens, which will doubtless continue during the next decade; and

second, the increasing production of pig iron. At present about 60 per cent of the coke manufactured is made in byproduct ovens. This percentage has been increasing steadily during the past 20 years and will continue to increase during the next 10 years, probably to about 80 per cent. That such estimate is reasonable is clearly indicated from the history of the past few years as shown by the curve in Fig. 1.

It is not to be expected that byproduct coke production will altogether supersede beehive coke production. The demands for coke for steel making fluctuate from year to year, and it is generally believed to be uneconomical to manufacture all of the coke in byproduct ovens during a period of peak demand. To attempt this would result in maintenance of greater byproduct oven capacity than can be used regularly by the steel industry. The surplus coke-producing capacity above that necessary to meet the average demand will, therefore, probably be in the form of beehive ovens, which require

Table I—Ammonia Nitrogen Available in the United States From All Sources

(Expressed in net tons of nitrogen, round numbers.)

Source	1921	1922 (Preliminary)	1923 (Estimated)
From coke ovens:			
In ammonium sulphate	54,400	72,100	103,000
In ammonia liquor	13,200	20,600	20,600
From gas works:			
In ammonium sulphate	400	400	400
In ammonia liquor	5,800	5,800	5,800
From bone distillation, etc.	200	200	200
From the air	1,000	3,100	3,500
Imports of ammonium sulphate	1,000	1,000	200
Totals	76,000	103,200	133,700

Note:—Data for nitrogen from coke and gas for 1921 based on U. S. Geological Survey figures. Imports figures from Bureau of Foreign and Domestic Commerce records. Other quantities are estimates.

a much lower investment per unit of capacity and hence less unnecessary investment in periods of low coke demand. Moreover, beehive ovens can be started up and shut down from time to time, according to the coke requirements, without serious difficulty or danger of damage to the ovens; whereas shutting down a byproduct oven plant is both difficult and likely to result in serious structural damage to the ovens. For these reasons it is believed probable that not more than 80 per cent of the total coke production will be in byproduct ovens even 10 years from now.

The increasing efficiency in fuel use in blast furnaces tends toward production of pig iron with lower coke consumption. There is also a tendency to use the electric furnace and other processes of iron and steel manufacture that do not require coke. But all of these tendencies together in 10 years will probably not make any large percentage reduction in the coke requirement even for the tonnages of iron required at present. The decrease in coke requirement from such causes will certainly be very much less than the increases in coke requirement resulting from increases in steel consumption.

In the past 20 years the output of pig iron has increased at the rate of approximately 1,000,000 gross tons per year. A similar increase during the next 10 years would result in approximately 10,000,000 tons increase in the annual coke requirement. It seems unsafe, however, to estimate quite as great an increase as this in coke demand for steel making. However, about two-thirds such increase in the byproduct coke production because of increasing demand for steel products seems conservative. The following estimates

Table II—Disposition of Ammonia Nitrogen in the United States

(Expressed in net tons of nitrogen.)

	1919	1921	1922 (Preliminary)	1923 (Estimated)
In mixed fertilizers	33,000	22,100	42,000	51,000
As ammonium sulphate fertilizer	2,000	1,500	2,000	2,000
In anhydrous ammonia	11,500	11,500	12,500	13,500
In aqua ammonia	3,100	4,100	5,000	5,000
In ammonium salts	800	1,500	2,000	2,000
Exported in ammonium sulphate	11,300	23,700	33,600	35,000
Total	61,700	64,400	97,100	108,500

of the future output of coke byproducts are based upon the above assumption.

Coke-oven gas is continually replacing water gas, retort coal gas and natural gas for city distribution. However, the rate of substitution is dependent upon many factors, among them the relative price of bituminous coal and gas oil, the relative price of anthracite and coke, and the rate at which available supplies of natural gas are exhausted from the fields that now furnish this gas for the larger cities of the Ohio River and Great Lakes region. The substitution of coke-oven gas has been going on for a number of years, but the period is so short as not to have established even a general trend that can be used as a definite guide for the next decade. The estimates of the extent to which coal will be carbonized for these purposes are, therefore, distinctly guesses.

At the present time more than 200,000,000,000 cu.ft. of carburetted water gas is made and sold annually in the United States. This gas is made from anthracite

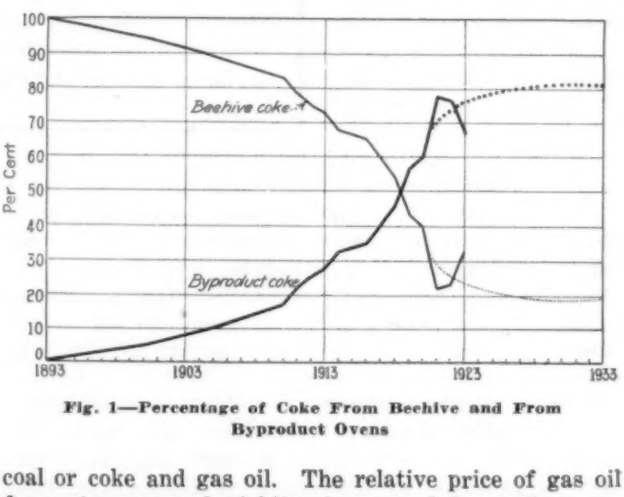


Fig. 1—Percentage of Coke From Beehive and From Byproduct Ovens

coal or coke and gas oil. The relative price of gas oil for water gas and of bituminous coal for coal gas or coke-oven gas manufacture often determines whether coal gas or carburetted water gas will be made, though the lower investment needed for a water gas plant is also often the determining factor. It is believed that at least 20 per cent of the present water gas output will be superseded by an equivalent coke-oven gas production within the next 10 years because of changing relations of fuel costs and other factors. This substitution would require manufacture of 40,000,000,000 cu.ft. of coke-oven gas. The production of this gas would be accompanied by a production of about 10,000 tons per year of ammonia nitrogen, if the present ratio of ammonia to gas were maintained (25 lb. of sulphate production is assumed for each 10,000 cu.ft. of surplus gas).

The supplies of natural gas in states east of the

Mississippi River are being rapidly depleted and must be replaced by other kinds of gas or large industrial and residential districts will be without gas supply. To some extent new natural gas supplies may be developed; but already it is evident that the quantity of natural gas that can be obtained for use in these Eastern states will be less and less from year to year. It is believed a reasonable assumption that within the next 10 years coke-oven gas will supersede as much as 20 per cent of the present supply of natural gas in the ten states east of the Mississippi River that have this fuel. The coke-oven gas has only about half the heating value per cubic foot that the natural gas has; but because of its greater cost, greater care will have to be exercised in its use and some present users will not be able to afford gas but will turn instead to solid fuel. As a result it is probable that about an equal volume of coke-oven gas will satisfy the demands for gas which are continued under the new conditions. This means that an additional 80,000,000,000 cu.ft. of coke-oven gas would be made to substitute for natural gas. The ammonia nitrogen which would be produced as a byproduct of this gas manufacture would be approximately 20,000 tons per year.

Table III—Estimated Production of Nitrogen From Coal in 1933
(Expressed in net tons of nitrogen)

Present production at byproduct ovens	120,000
Increase from substitution of byproduct coke for beehive coke	40,000
Increase because of increasing iron and steel demand	25,000
Increase from substitution of coke-oven gas for present carburetted water gas	10,000
Increase from substitution of coke-oven gas for natural gas	20,000
Increase because of new demands for city gas and coke for domestic or gas-making use	25,000
Total from coke ovens	240,000
Estimated present production at coal-gas works and from other sources	10,000
Total ammonia nitrogen excluding any increases in nitrogen fixed from the air	250,000
Equivalent in ammonium sulphate, tons	1,250,000

Ammonia From City Gas

The demand for city gas has been increasing at an amazing rate during recent years. To meet this increasing demand there has been a great tendency both to purchase gas from companies operating coke ovens in connection with steel works and to install coke-oven plants to be owned and operated by gas companies. Where it is possible to develop a market for coke as a household fuel to substitute for anthracite, conditions are particularly favorable for such new coke-oven installations. The appreciation of the value of coke as a domestic fuel and as a water-gas fuel in the place of anthracite is constantly increasing. It seems likely, therefore, that new coke-oven installations planned to make gas for city supply and coke for domestic or gas works use will be numerous in the next 10 years. There is no basis to estimate exactly how great such increase will be, but it appears probable that these demands will be sufficient to result in new coke-oven plants that will carbonize at least 10,000,000 tons of coal per year by 1933. Such increase in coke and gas output would be accompanied by the production of about 25,000 tons per year of ammonia nitrogen in addition to the quantities previously estimated.

All of the above estimates are believed to be conservative. Graphic representation of the trend is shown in Fig. 2, where the trend curve has been projected to the year 1933.

The several estimates above made are summarized in Table III, which gives the estimated annual output of byproduct nitrogen in 1933 on the assumption that each of the factors discussed above will have the influence estimated.

These estimates take no account of possible increases in ammonia production at gas works except through the use of new coke-oven installations. Such assumption is reasonable, because any new gas-works production of ammonia with equipment other than coke ovens would be only equivalent to that which has been assumed above. In other words, if vertical retorts or other coal-gas installations are made for the industry, the output of nitrogen from such plants would be substantially the same as if the new installations had all been coke ovens as above assumed. Therefore, the neglecting of the possibility of new retort coal-gas plants produces no significant change in the total estimate.

Cost and Price of Ammonium Sulphate

Since the ammonium sulphate made at both gas works and coke ovens is only one of several related products, there is not the same relation between its cost and its market price that must prevail with any independent product. It is in this respect very different from either Chilean nitrate or the nitrogen compounds made by fixation of nitrogen from the air, both of which must be sold at prices sufficiently above cost to make their independent production commercially profitable. Furthermore, it is practically impossible to determine exactly what is the cost of ammonium sulphate, or of the ammonia in liquor made at gas works or coke ovens. Costs of materials and of operation vary widely and even with similar plant conditions what would be called the cost in one plant would be very different from the so-called cost in another plant because of the different systems of cost keeping required under different local conditions.

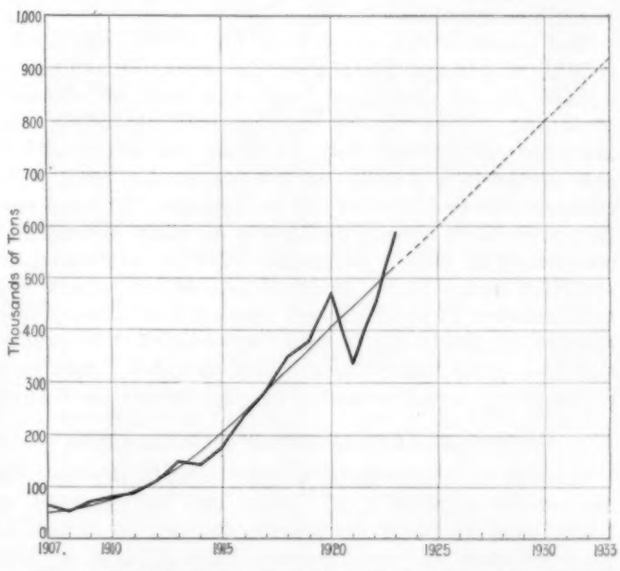


Fig. 2—Production of Ammonium Sulphate at Coke Ovens
The actual production is represented by the black line while the dotted line is the forecast of production during the next 10 years.

A detailed analysis of the cost of ammonium sulphate is not essential to an understanding of sulphate market conditions. It is clear that sulphate will be produced, and therefore must be marketed with reasonable

promptness, just so long as it is worth more in the competitive market than the cost to produce the material. Some of the important elements of cost of ammonium sulphate can be enumerated, but it is impracticable to estimate exactly the dollars and cents involved for each because conditions vary so widely from plant to plant.

Limits of Sulphate Production

In the case of byproduct coke ovens now operating, sulphate will be made so long as coke and gas are produced, and in about the present ratio of sulphate to coke, unless at any time it should happen that more money could be saved by stopping the sulphate production than is expected from the sulphate sales. In other words, sulphate will be made in approximately present quantity in existing plants so long as this can be done without actual loss. Even though the income from the sulphate sales exceeds only slightly the cost for material and labor, it would be to the financial advantage of the company to continue making it in order that it might contribute at least to this small extent to the general expenses of the company and to the return upon investment.

In Part I of the Nitrogen Survey report, Bain has estimated that Chilean nitrate will continue to be produced and marketed in the United States so long as the average price realized is not less than $35 per net ton, New York City. If the price falls below that figure, even the most advanced methods of production, transportation and marketing now known would not be sufficient to maintain the full supply to this country. And at a price of approximately $28 per ton, New York City, it is estimated that there would be practically no offerings. These two figures, therefore, can be used as a basis of comparison of probable future minimum price of Chilean nitrate at American ports.

The prices estimated by Bain for nitrate correspond roughly to $46 and $37 per ton for ammonium sulphate, figured on an equivalent basis per unit of nitrogen contained. These latter figures are, therefore, the lowest prices that are likely to result over any considerable period in a strictly competitive market until some cheaper nitrogen product can be developed or some new improvement in nitrate production be made beyond that considered in Bain's estimates. Neither of these possibilities seems to be likely of realization within the next decade. It is, of course, possible that atmospheric nitrogen products can be made and marketed in quantities at a price below those indicated above. But such a possibility is not a matter for the immediate future.

Sulphate Equivalents of Nitrate Costs

Because of these facts, a price of $46 per ton for ammonium sulphate f.o.b. ovens can be regarded as lower than is likely to prevail for any considerable period within the next decade from present or prospective conditions in either Chilean nitrate supply or the atmospheric nitrogen industry. At this market price it is certain that present coke-oven plants will continue to make and market sulphate in all but rare instances. Such plants as might not continue sulphate production will be so few in number and small in output that they can properly be ignored for the purpose of the present estimate. It has been concluded, therefore, that sulphate production will depend rather upon coke and gas demand so far as present plants are concerned than upon the market price of the sulphate.

On the other hand, there is no likelihood that the production of sulphate per ton of coal used in present plants can be made materially greater than at present. Without regard to the price of sulphate almost perfect recovery of the ammonia in this form is both commercially feasible and essential. Thus existing oven plants can be expected to make no more sulphate relative to their coke output than they do at present.

New byproduct coke plants will be erected only as financial profit is anticipated from them. Thus the price expected from the sulphate will in some instances determine whether new ovens can be profitably built, though of course the demand and market for coke and gas will be far more important. As explained above, it is usual to estimate that approximately 25 lb. of sulphate would be made per ton of coal and that this can be marketed at $60 per ton f.o.b. ovens. If higher or lower price is expected, then just in proportion would there be greater likelihood of new oven installations. With less favorable prospects, the reverse is true.

Effect of Reduced Selling Price

In any case where sulphate cannot be marketed at as favorable a price as usual the other products must make up the deficiency in income. For example, if a new plant could count upon only $46 per ton for sulphate, this would mean a decrease in income of 17½ cents per ton of coal treated. To be attractive to the investor, these 17½ cents would have to be made up on other products, such as coke, gas, tar or motor benzol, the other principal products of the plant. This item of 17½ cents per ton is not a large percentage of the total income expected from the sale of products, since usually several dollars are realized from the marketing of the products from each ton of coal. Yet this item is sufficient so that it might under certain circumstances make the difference between only a fair profit and a really satisfactory return upon the new investment.

As pointed out above, the lowest probable future price for sulphate is such that it will have relatively little influence upon the probable rate of coke-oven development. The urgency of the demand for coke and the necessity for greatly increasing the production of city gas from coke ovens will be sufficiently large to offset almost entirely any restrictive tendency that may occur during the next 10 years due to lower sulphate prices. As a generalization, therefore, it seems very certain that the estimates of sulphate production based upon coke and gas requirements presented earlier in this section of the report can be regarded almost independent of the probable future sulphate price.

Correction

In the abstract of "Fundamental Factors of Corrosion," by Walter G. Whitman and R. P. Russell, in the April 28 issue the p_H of a saturated solution of ferrous hydroxide, given as 8.5, should have read 9.5. The writers also wish to correct a misunderstanding caused by the phrase, "Further work by the writers has resulted in the following additional conclusions," for certain of these conclusions had been arrived at prior to any work by the writers.

Recent Advances in Electroplating

Leading Workers in the Industry Describe Latest Developments in the Technology of Nickel Deposition and the Electroplating of Steel With Zinc

THE electrodeposition session of the Philadelphia meeting of the American Electrochemical Society was opened with a short talk by Dr. William Blum, of the United States Bureau of Standards. Dr. Blum is a leader in bringing to the electroplating industry the advantages of research and scientific methods. His endeavors have been eminently successful and the contact between the bureau and the larger plants throughout the country has become quite complete. Dr. Blum was therefore in an ideal position to review the status of electrodeposition in the country at the present time, to describe the more important recent developments and to sound the keynote for future work.

This keynote was an exhortation for the scientific man to see the side of the practical man and still to keep sight of the scientific side; and for the practical man to do his best to see the scientific side of his work. The value of such co-operation has already been proved. The only thing to be desired is that more and more shall the practical and the scientific men "get together."

Conductivity of Nickel-Plating Solutions

L. D. Hammond, of the Bureau of Standards, studied the conductivity of nickel sulphate solutions of various concentrations, and the effect upon the conductivity of common additions to nickel-plating baths. Ammonium chloride was found to have the greatest relative effect in decreasing the resistivity and a beneficial action on the formation of good deposits. C. P. Madsen could not subscribe to Mr. Hammond's findings. It has been his experience that the nickel chloride was the only chloride permissible; other chlorides form double salts that will cause trouble. Edwin Smith, Jr., found that the addition of chloride to the bath was the solution of passivity. Dr. Colin G. Fink, of Columbia University, referred to his researches on electrolytic tin; in the case of tin also, the addition of a small amount of chlorine ions counteracted anodic polarization. Mr. Hogaboom measured the concentration of nickel and chlorine in baths during large-scale operation and found that as the Cl concentration went down the Ni concentration would likewise drop.

Nickel Anodes for Electroplating

Dr. Blum and C. T. Thomas, of the Bureau of Standards, Washington, investigated the behavior of various makes of nickel anodes when in continued service in the plating bath. The ideal nickel anode must corrode uniformly, with low polarization and high anode current efficiency, and must not introduce any deleterious substances into the solution. The investigators found that in solutions containing only nickel sulphate and boric acid the anode current efficiency of all forms of nearly pure nickel is low.

All forms of clean nickel anodes corrode with high anode efficiency in solutions containing appreciable amounts of chlorides. Ammonium sulphate or fluorides in the solutions do not materially increase anode corrosion. Additions of carbon to cast nickel increase anode efficiency and promote uniform corrosion. Carbon-free cast nickel containing nickel oxide corrodes more smoothly, at a less positive potential and with higher anode efficiency than does low-carbon cast nickel. Sulphur is deleterious in cast anodes, as it causes selective corrosion and detachment of particles. This effect is most marked in low-carbon anodes and is not overcome by the addition of magnesium. Copper in anodes has little effect on their behavior, but if present in appreciable amounts it will enter the solution and cause inferior cathode deposits. Iron in nickel anodes has a slightly beneficial action upon the smoothness of corrosion, but not sufficient to warrant its intentional addition. Tin and silicon have little effect on the behavior of the anodes. They pass into the sludge and do not directly affect the deposits. Electrolytic and shot nickel anodes show more tendency for detachment of nickel particles than do high-carbon cast-nickel anodes. As a basis of specification for cast-nickel anodes, it is tentatively suggested that they should be sand cast and contain not less than 95 per cent nickel (plus cobalt) and 1.25 per cent carbon, and not more than 0.25 per cent copper or 0.10 per cent sulphur. Iron, silicon and tin may be permitted in amounts up to 1 per cent of each, but are not recommended.

That the subject of "Nickel Anodes" is an important one was evidenced by the large amount of discussion following the presentation of the paper. George B. Hogaboom, of New Britain, Conn., called attention to the fact that according to his experience nickel anode sludge contains over 80 per cent Ni. Probably oxide or chloride is formed first and then nickel sulphate during the process of anodic dissolution. Thomas's and Blum's values are based on comparatively short runs. Shot nickel has not met with success on a large scale. If the anode contains free graphite, part of this will pass into suspension in the solution and be codeposited with the nickel on the work. Upon actual weighings it was found that with rolled nickel anodes 73 per cent Ni was cathodically deposited, whereas with cast-nickel anodes only 60 per cent of the Ni was deposited.

Charles P. Madsen, of New York, referred to tests carried out with 1,000-lb. nickel anodes. No addition can be made to a nickel anode without eventually causing trouble. Traces of Fe, Pb and H in cathode nickel appreciably lower the quality of the metal. "But," Mr. Madsen assures us, "the anode problem has been solved." Using an electric furnace with a very pure basic lining and casting the metal very quickly have resulted in an almost perfect anode. The molten metal is deoxidized in the ladle with a well-defined amount of magnesium. The use of manganese is to be avoided. Mr. Skowronski added that he too had found manganese to be a deleterious impurity, as it tends to build up in

the electrolyte until a point is reached when Mn is codeposited with the Ni.

F. Taylor, of A. P. Munning Co., Matawan, N. J., recalled his early experience in the manufacture of nickel anodes and how some customers insisted on a 10 to 15 per cent Fe content. It was his opinion that the field for rolled nickel anodes is very limited. Mr. Hogaboom displayed an old nickel anode badly crusted over with what he considered an oxide of nickel, but Mr. Skowronski suggested that there might be sulphides present. Edwin Smith, Jr., of the Edison Storage Battery Co., described the results obtained at the Orange factory and emphasized that the physical structure of the anode was not only important but that very often the physical structure was the only point worthy of consideration. When Mr. Madsen inquired whether the Edison Battery Co. had ever tried nickel anodes containing 99.75 per cent Ni and 0.25 per cent Fe, Mr. Smith replied that his experience had been with anodes not nearly as pure as those.

Polarization vs. Structure in Nickel Deposition

Prof. V. Kohlschütter, of the University of Bern, has for 20 years been investigating the properties of electrodeposited metals, in particular nickel. Accordingly, Professor Kohlschütter's contribution to the symposium was much appreciated. He carefully reviewed the many investigations that have appeared within the last score of years and summarized his findings as follows:

"The abnormal potential in nickel deposition bears a direct relation to the smoothness of the plate, the hydrogen content of the plate and its tendency to contract and peel. Factors that will affect one of these abnormal properties will affect the two others as well. Eliminating the film of hydrogen gives rise to a more coarsely crystalline deposit; there is little or no contraction, and the abnormal polarization is largely eliminated. Substituting a film of carbon dioxide for that of hydrogen brings back the mirrorlike surface of the deposit and the tendency to contract, but does not bring back the abnormally high polarization voltage. Under ordinary conditions, nickel is deposited in a viscous film of hydrogen and in a highly dispersed form."

Dr. Per K. Froelich, research assistant at the Massachusetts Institute of Technology, discussed Professor Kohlschütter's paper at length. The main feature of the Kohlschütter hypothesis is a postulated hydrogen film on the cathode, acting as a dispersing medium for the metal initially deposited in a highly dispersed state. The tremendous activity of Ni as a catalyst in all kinds of hydrogenation reactions places this metal in a specific position among metals. Hence it does not seem logical to deduce a hypothesis of cathode reactions on observations made with nickel, and a generalization of the hypothesis to cover other metals does not seem justified. The film hypothesis is also offered by Professor Kohlschütter as an explanation for the abnormal potentials observed in nickel deposition. Dr. Froelich pointed out that in the simultaneous deposition of nickel and zinc potential irregularities occur very similar to those in the case of nickel. Does zinc in this case play the rôle of the hydrogen film "as a dispersing medium for the initially deposited finely dispersed nickel"? Up to the present time we have no direct proof of intermediate steps in the deposition of nickel or cathode reaction. The simplest explanation of the phenomenon is still the best one. The effect of hydrogen will in all probability have to be sought in the disturbing influence exerted by this element on the process of building up the normal space lattice of the crystalline metal.

H. E. Haring, of the Bureau of Standards, reported that he had found that maximum anode and cathode polarization occurs practically at the beginning of electrolysis. This is in accordance with Professor Kohlschütter's views.

Mechanically Perfect Electrolytic Nickel

Three years ago Charles P. Madsen made the first announcement before the society of his new ductile nickel. At the Philadelphia symposium he submitted a second communication giving a more detailed report of his many years of research. Ordinary electrolytic nickel is brittle and often mechanically imperfect. Furthermore, ordinary electrolytic nickel tends to become cold-short. Hydrogen alone is not the principal cause of electronickel trouble. Organic material and iron are far more important, and their effect depends upon their condition. Soluble organic material is the principal cause of lack of ductility. Organic colloids cause failure after heating the metal, and larger organic particles enter into pit formation during cathode deposition. Under proper conditions we can obtain electronickel almost equal to pure gold in ductility. The use of hydrogen peroxide in the bath is an absolute cure for pits, and exerts other beneficial effects.

Perfect electrolytic nickel can be produced from a bath containing absolutely nothing but nickel salts and a little free acid, by using an anode containing absolutely nothing but nickel. Perfect electrolytic nickel can be produced from a bath made from commercial nickel salts and using an anode low in iron, but otherwise pure, by the use of hydrogen peroxide in the bath. Accurate p_H control is made necessary only by the presence of iron. In the deposition of nickel from aqueous electrolytes a high bath temperature is necessary for best results. The cause of "carbuncles" is suspended impurities above colloidal size in the electrolyte.

Mr. Madsen's paper was discussed by Messrs. Blum, Froelich, Skowronski, Fink and Thompson. Froelich asked whether a diaphragm might not keep the organic materials away from the cathode. Mr. Madsen replied that so far no diaphragm has been of any value. He showed samples of his nickel in various forms, such as sheet, very fine wire, etc., and demonstrated the bending test on a piece of foil. Dr. Fink mentioned briefly some of the many commercial possibilities of the ductile nickel metal.

Zinc and Zinc-Mercury Coatings on Steel and Their Relative Corrosion Resistance

Dr. C. J. Wernlund, of the research laboratory of the Roessler & Hasslacher Co., has continued his studies of the company's new zinc coating for iron and steel. It differs from the old familiar galvanized coating not only in composition but also in durability. The new zinc plate contains about 2 per cent Hg. Atmospheric corrosion tests on coated iron and steel and salt spray tests show that the Zn-Hg coat is decidedly superior to that of the ordinary Zn coat. The anodes used in the new bath contained 2 per cent Hg. The electrolyte: 37.5 grams per liter of zinc cyanide (55 per cent Zn), 22.5 grams NaCN and 30 grams NaOH. It was found

to be better practice to introduce the mercury into the bath by means of the anode than to add small quantities of Hg salts to the bath at regular intervals. Messrs. Hogaboom, Stewart, Thompson and Colvin took part in the discussion.

Intermittent Immersion Test as Aid in Evaluating Zinc Coats Plated on Iron and Steel

The research laboratory of the Western Electric Co. has for many years been interested in the development of a more efficient test for evaluating the quality of an electrodeposit of zinc on iron and steel. F. F. Farnsworth and C. D. Hocker carried out a long series of tests and have developed a new intermittent immersion test which is reasonable and discriminating. It consists of a series of immersions of the samples in a solution of ammonium chloride, alternating with periods of drying in the air. The test shows up discontinuities and thin spots in zinc coatings; it differentiates zinc coatings plated from a sulphate and from a cyanide bath; and it may be used to compare the effectiveness of different methods of precleaning the iron and steel before plating.

Commenting upon the new test, Dr. Wernlund mentioned that he had been using the test for the past 5 months after consultation with the authors, and that he had found the test a very reliable one. Dr. Fink stressed the importance of the intervening "drying period" and felt that the test would be found more accurate as to results than the old salt spray test, especially in the case of metals other than zinc. Whereupon Dr. Blum remarked that an ammonium chloride spray test ought to be tried out and compared with the Farnsworth and Hocker test. Messrs. Thompson and Wernlund believed that there would not be very much difference in results on zinc coatings whether tested by the spray method or the new intermittent method.

Dezincification of Brass

A study of the underlying process in the dezincification of brass and a number of other alloys was undertaken by Cleveland F. Nixon at the University of Wisconsin. He found that oxygen or an appropriate copper salt in solution is essential to start the dezincification of brass. Solutions of copper acetate and other slightly ionized salts do not incite the dezincification of brass. Monel metal and german silver proved entirely resistant to selective corrosion. This finding is corroborated by experience. Monel has been used extensively and successfully for marine fittings. The condition of the surface is an important factor in dezincification. Whether or not the surface offered to corrosion is the original cast or rolled surface, or has been recently fractured, filed or cold-worked, sometimes determines whether or not dezincification will occur. Brass, though the only commercial alloy subject to dezincification, is by no means the only alloy susceptible to this type of corrosion. Copper-aluminum (70-30), manganese-copper (25-75) and cadmium-magnesium (85.7-14.3) were found subject to selective corrosion.

Rate of Dezincification

The rate of dezincification is dependent to a considerable extent upon the porosity of the redeposited metal. All alloys tested containing more than 90 per cent of copper were not subject to dezincification, no matter what constituents made up the remaining 10 per cent. In general, commercial brasses are all subject to dezincification; heat-treatment and the presence or absence of the beta constituent are only minor details. Tin, however, slows down the action to a considerable extent. Antimony brass is of little use in resisting dezincification; silicon is beneficial in slowing down selective corrosion in sea water; while nickel and arsenic brasses appear promising, and are worthy of special study.

Commenting on these interesting results, Charles H. Eldridge, metallurgist, Metropolitan Museum of Art, briefly described the slow process of corrosion observed in the case of copper-silver alloys which had been "under test" for more than 3,000 years. A slow decuprification of the coin alloys took place, leaving behind an almost pure silver metal. The copper was in the surrounding crust, mostly as carbonate.

Effect of Rubber on Paint

According to an account in the current issue of *India Rubber World*, the addition of rubber to paint lends desirable properties. The effect of rubber on paint is threefold: (1) it improves the flow and appearance; (2) it increases elasticity; (3) it increases resistance against atmospheric and weather influences.

The beneficial addition of rubber to certain gum varnishes, particularly those that dry quickly and therefore must not contain a large percentage of oil, will be readily realized, because with the reduced percentage of oil these varnishes are apt to become brittle after drying. The rubber, however, not only gives such varnishes or paints manufactured with them increased elasticity but also appears to combine to a remarkable degree with the various gums. This, of course, is explained by the fact that varnish gums and rubber are both derived from the same source, that is, they are a condensed sap of various trees. The difference between them, however, is that all the gums in their nature are hard and brittle, while rubber is extremely elastic and pliable. If such an improvement can be effected with varnish, it becomes the greater with a varnish paint, because the presence of pigment in the varnish paint increases the brittleness of the paint and reduces its resistance against atmospheric influences, but the addition even to a pure oil paint has been found by many manufacturers to be beneficial.

Hitherto rubber has been mostly dissolved in certain hydrocarbons that have a very limited capacity for dissolving rubber, and as a result such solutions were very weak in rubber. It has been found that by melting rubber together with a very moderate percentage of another material, it could be very readily mixed with hydrocarbons, thereby obtaining a highly saturated solution of rubber.

For some years experiments have been made with paints containing rubber in order to ascertain the exact proportion of rubber needed in a paint. For this purpose various paints were mixed with various percentages of rubber, starting with ½, 1, 2, 3, 4 and 5 per cent. The results of these tests show that a 1 per cent addition by weight to mixed paint gives the best results; that is, superior to the lesser percentage or to no rubber at all, as well as to the higher percentages. And by increasing the rubber content above 1 per cent the resistance against atmospheric influences again became gradually less and less.

Equipment News

From Maker and User

Comparative Costs of Centrifugal Drives

Use of Turbine Results in Important Economies in Steam Consumption, Labor and Maintenance Charges

By Matthew McIlhenny,
Victor Dye Works, Philadelphia, Pa.

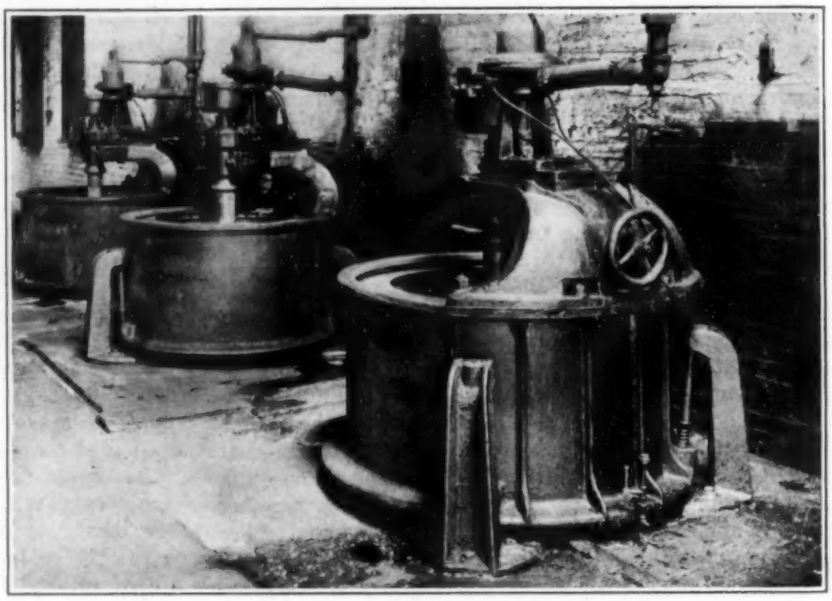
The dyehouse of the Victor Dye Works handles rug and carpet yarns. After the skins are dyed and washed they are trucked to three 42-in. Fletcher turbine-driven extractors. The centrifugals handle 15,000 lb. of yarn (weighed on a dry basis) each working day of 8½ hours. The turbine is started by opening a globe valve, and it reaches its full speed of 800 r.p.m. in 1 minute and 45 seconds. Five minutes after the valve is opened the batch is finished, the steam shut off and the brake applied. The brake is capable of stopping the extractor in 50 seconds. Since each batch weighs 125 lb. and each extractor turns out 5,000 lb. per day, there are forty batches per day per machine. This is equivalent to 12¾ minutes per batch.

Previous to purchasing the turbine-driven extractors, the company operated three engine-driven extractors with cone transmissions. Although these machines were scrapped about 2 years ago in order to install the turbine-driven ones, the company has reason to believe that it has already been repaid five times over by the savings effected. Before citing the manner in which these savings were determined, it is perhaps appropriate to review some of the advantages of the turbine-driven machine. In the first place it is quicker to start and to stop. It gets up to speed in less than 2 minutes compared with 4 or 5 minutes for the engine-driven machine. The drive is positive and the speed is always maintained at the correct rate by the governor. With the engine-driven machine, however, there was difficulty especially on wet and damp days when the friction cones became slippery and it was impossible to drive the extractors at rated speed. Their limited power also rendered it difficult to maintain the desired speed.

Table I—Cost of Operation—42-In. Fletcher Turbine Extractor

Depreciation, $1,981 ÷ 25 years life	$79.24
Average interest* at 6%, $\frac{26}{25} \times \frac{\$1,981 \times 0.06}{2}$	61.81
Repairs, maintenance and basket renewals	75.00
Oil, 13 gal. at $0.60	7.80
Steam (crediting turbine with heat in exhaust steam)	12.98
Labor, 8½ hr. per day × 260 days × $0.80 × ⅓	589.33
Total operating cost per yr.	$826.16
Cost per day, $826.16 ÷ 260 days	$3.18
Cost per 1,000 lb. of yarn, $826.16 ÷ 1,300	$0.636

* Allowing for interest earned by depreciation reserve.



Three Turbine-Driven Centrifugals in Plant of Victor Dye Works

The importance of the latter factor has been demonstrated to us by the fact that increased speed of the turbine extractor now results in a drier yarn. Another important advantage of the turbine type is its greater dependability and lower repair cost. The engine drives were constantly giving trouble due to a larger number of moving parts.

Lower Operating Cost

The operating cost of these extractors has been demonstrated to be very low. Depreciation, figured on a basis of a lifetime of 25 years, amounts to $79.24 per year per machine. Repairs, maintenance and basket renewals do not exceed $75 per year. The exhaust steam from the turbine is used in the drier and for heating water in the dyehouse. It is possible, therefore, to charge to the extractor only the cost to cover the percentage of heat removed from the steam by the turbine, which amounts to only $0.042 per 1,000 lb. of yarn. Adding average interest, oil and one-third of the labor of the man who operates, loads and unloads the three extractors, you have a total annual cost per extractor of $826.16, or $3.18 per day. Figured on the basis of yarn handled, this amounts to $0.636 per 1,000 lb., a very reasonable figure.

The principal saving is due to the fact that the plant is able to handle in 8½ hours the volume of work that formerly required an average of 10¾ hours, thus saving 1¾ hours of operating labor per day. The accompanying tables show this to amount to $364 per year. Furthermore, since the yarn leaving the turbine extractor is drier than was previously the case, it is now possible to dry the same quantity of yarn in the same drier in 8½ instead of 10¾ hours. Since the drier uses $3.25 worth of steam per hour, the annual saving is $1,478.75 on this item. The saving of 1¾ hours per day for the two men who load and unload the drier adds another annual saving of $728.

Table II—Estimated Saving Over Engine-Driven Extractors

In labor loading, unloading and operating extractors, 1.75 hr. per day × 260 days × $0.80 per hr.	$364.00
In labor loading and unloading drier, 1.75 hr. per day × 260 days × $0.80 per hr. × two men	728.00
In steam used by drier, 1.75 hr. × 260 days × $3.25 per hr.	1,478.75
In labor repairing engines, 520 hr. at $0.80 per hr.	416.00
In engine repair parts	150.00
Total annual saving due to turbine extractors	$3,136.75

Tables I and II, which accompany this article, are based on data from a certified performance survey made by the A. C. Nielsen Co., Chicago, Ill. Table I shows the actual operating cost of a 42-in. turbine-driven centrifugal per year, per day and per 1,000 lb. of yarn processed. Table II shows the estimated annual savings of the turbine-driven extractor over the estimated annual operating cost of an engine-driven extractor. The accompanying photograph, supplied by the Fletcher Works, Philadelphia, Pa., maker of the extractors, shows the three machines with turbine drive as they are installed in the Victor Dye Works in that city.

Review of Recent Patents

New Ideas on Coal Products

Closed Circuit Ammonia Recovery System, Automatic Regulator for Producers and New Retort Designs Among Recent Inventions

IN recovering ammonia from coal gas it is desirable to reduce the amount of fresh water to a minimum in order to obtain as concentrated an ammonia liquor as possible. Bates Torrey, Jr., describes such a system in Patent 1,487,768, March 25, 1924, assigned to Semet-Solvay Co., Syracuse, N. Y.

In the hydraulic main the gas is sprayed with a liquor which circulates through part of the system, as will be more evident in the following discussion. Liquor and tar from the main go to a settling tank, the tar being drawn off to storage and the liquor to a collecting tank.

The gas passes to a cooling tower, where it is showered with cooled water of condensation from the gas itself. That is, the liquor which collects in the bottom of the cooling tower is pumped through cooling coils and is then used to spray the gas, which is cooled to about 40 deg. C. Any tar that separates is sent to the tar storage, and surplus condensate is added to the liquor in the collecting tank. This forms the source of supply for the liquor used to spray the gas in the hydraulic main. Thus the gas cooler, with the gas main and the connecting pipes, forms a closed circulating system in which condensate from the gas is continuously recirculated through the main. Most of the tar and fixed ammonia is removed from the gas.

Excess liquor from the system is drawn off at a point where it is relatively free from tar, mixed with a weak solution of free ammonia obtained at a later stage, and the mixture is passed through cooling coils and then sprayed into a second gas-cooling tower, reducing the gas temperature to 20 or 25 deg. C. A large proportion of the free ammonia in the gas is removed in this tower, so that the liquor overflow is of maximum ammonia concentration. After tar has been allowed to settle out, the liquor goes to an ammonia liquor storage tank.

The small amount of free ammonia remaining in the gas is recovered and returned to the second gas-cooling tower by means of a series of four scrubbers operated counter-current.

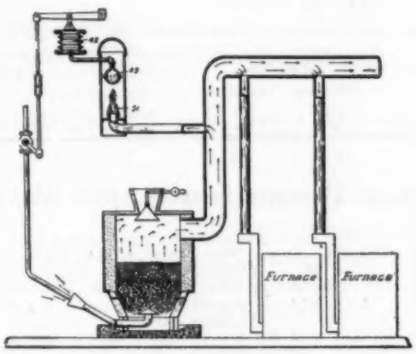


Fig. 1—Regulator for Gas Producers

Fresh water is fed to the final scrubber and the weak free ammonia solution from the first scrubber goes to the second gas-cooling tower as outlined above.

It will be noted that all of the finished product is obtained at one point in the system and that it contains substantially all of the free and fixed ammonia at the maximum possible concentration.

Regulating Quality of Producer Gas

In order to make certain that the quality of gas from a producer does not fluctuate, Thomas Cureton, of Dayton, Ohio, has developed an automatic regulator (Patent 1,488,869, April 1, 1924, assigned to Gas Research Co., Dayton, Ohio.)

A small portion of the producer gas passes from the delivery main through a pipe to the burner, 31 (Fig. 1). This has a fixed orifice so that the calorific intensity of the flame varies with the pressure and quality of the gas. This variation is translated into mechanical movement by means of the changes in vapor pressure of a liquid contained in the vessel 43, supported directly above the flame. Through the siphon bellows 42, these pressure changes are transmitted to the valve on the steam line, thus effecting the desired regulation of the gas produced.

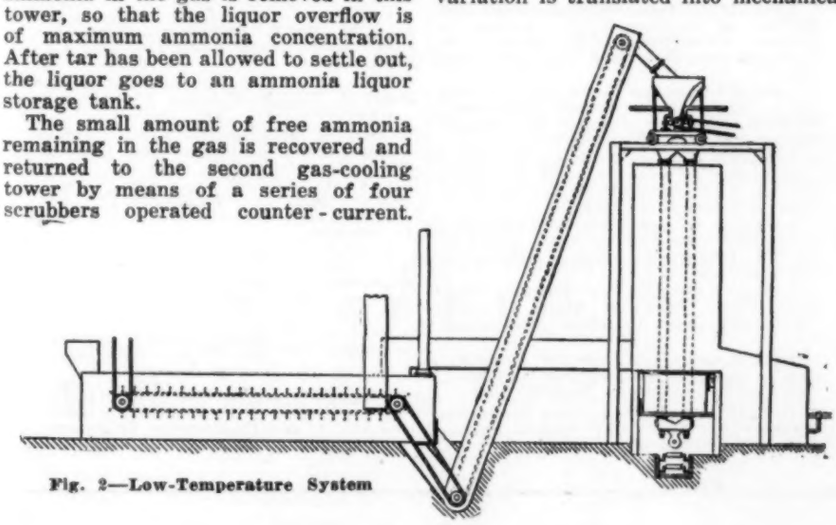


Fig. 2—Low-Temperature System

Carbonising Retort

George W. Wallace, of East St. Louis, Ill., has modified his design for an oil-shale retort so as to make it adaptable for use with coal. It is described in a joint patent with Arthur W. Warner, of Media, Pa. (1,490,354, April 15, 1924, assigned to Wallace Coke, Oil & By-Products Co., East St. Louis, Ill.)

A perforated draw-off duct is placed in the center of the carbonizing chamber and coal is charged with the space between the duct and the side walls of the chamber is filled. As heat is applied externally through the chamber walls, carbonization takes place from the wall toward the central duct. Gases and vapors evolved pass out through a water-seal at the lower end of the duct.

Low-Temperature Carbonising System

A feature of the low-temperature system for carbonizing lignite described by Ernest Owen, of New York (Patent 1,486,794, March 11, 1924), is the substitution of a preheating arrangement for the checkerwork regenerators usually employed. Before entering the retort, the coal must go between two horizontal heating chambers through which the waste gases from the retort pass. By this arrangement the coal supply is heated enough to drive off moisture and some of the more volatile matter. The coking tubes or retorts are vertical, each retort having a hollow central collector shaft also provided with blades to stir the charge. Volatile products are drawn off through this hollow shaft. (See Fig. 2.)

Books Received

Encyclopedia of Welding

WELDING ENCYCLOPEDIA. Compiled and edited by *L. B. Mackenzie* and *H. S. Card*, of the editorial staff of the *Welding Engineer*. Third edition, 360 pages, illustrated. Welding Engineer Publishing Co., Chicago. Price, $5.

In 1921 the wealth of information collected by the editors of the *Welding Engineer* made possible the first edition of the Welding Encyclopedia, a reference book containing under one cover complete information regarding all phases of welding, its technique and the apparatus employed. In 1922 a second edition rounded out the encyclopedia and now a new third edition still further broadens the scope of this work.

The first portion of the book is "encyclopedic" in character and is made up of technical information alphabetically arranged. Further along electric arc, electric resistance, oxyacetylene and Thermit welding are covered in separate chapters in great detail and

the advice of authorities in these fields is given not only in procedure but also in the design of welds for various conditions. Other chapters on allied subjects add to the book's value as a text as well as a book of reference.

An addition in the new edition of particular interest to the chemical engineer covers the extensive developments that have been made in recent years in the welding of tanks and pipes.

Analysis

NOTES ON CHEMICAL ANALYSIS. By *Archibald Craig*. 162 pages. Chemical Publishing Co., Easton, Pa. Price, $2.50.

A collection of methods and suggestions on glass-working, tabulation method for chemical calculations, and fundamental operations of analysis.

ANALYTICAL CHEMISTRY: Volume II, Quantitative Analysis. Sixth Edition. Based on the text of *F. P. Treadwell*, translated, revised and enlarged by *William T. Hall*. 811 pages. John Wiley & Sons, New York. Price, $5.

At least 20 per cent of this latest edition of Treadwell-Hall is unlike the German text, as it has been the aim to make the methods conform to the best American practice.

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS. *By William N. Lacey*, associate professor of chemical engineering, California Institute of Technology. 95 pages. Macmillan Co., New York. Price, $1.50.

This book forms the outline for a course designed to make the student familiar with the use of all types of instruments employed in analytical work. It includes such equipment as refractometers, polariscopes, pyrometers, penetrometers, viscosimeters, microscopes, calorimeters, and many others.

TESTED METHODS OF MINERAL ANALYSIS. By *B. T. Kitto*. H. F. & G. Witherby, London. Price, 7s. 6d. Obtainable in America from International News Co., New York.

Clear, concise details on methods that have given accurate results.

American Patents Issued April 29, 1924

The following numbers have been selected from the latest available issue of the *Official Gazette* of the United States Patent Office because they appear to have pertinent interest for *Chem. & Met.* readers. They will be studied later by *Chem. & Met.'s* staff, and those which, in our judgment, are most worthy will be published in abstract. It is recognized that we cannot always anticipate our readers' interests, and accordingly this advance list is published for the benefit of those who may not care to await our judgment and synopsis.

15,826—Process of Making Combustible Gas. William Wallace Odell, Pittsburgh, Pa.

1,491,794—Tar Extractor and Scrubber. Albert L. Galusha, Sharon, Mass.

1,491,795—Poke Ball for Gas Producers. Albert L. Galusha, Caldwell, N. J.

1,491,826—Beater Engine. Ralph J. Serpas, Kalamazoo, Mich.

1,491,841—Apparatus for Pulverizing and Separating Granular Materials. Williard J. Bell, Newaygo, Mich.

1,491,881—Steel Method, Mold and Ingot. John E. Perry, Sharon, Pa., assignor to Valley Mould & Iron Corporation, Sharpsville, Pa.

1,491,897—Lower Disk for Rotary Crushers. Judson M. Blake, Chicago Heights, Ill., assignor to American Manganese Steel Co., Chicago, Ill.

1,491,913—Copper-Iron-Nickel Alloy. Henry C. Kirk, Roland Park, and George H. Dumler, Baltimore, Md.

1,491,916—Purifying and Deodorizing Isopropyl Alcohol. Matthew D. Mann, Jr., Roselle, and Robert B. Lebo, Elizabeth, N. J., assignors to Seth B. Hunt, trustee, Mount Kisco, N. Y.

1,491,929—Method of Making Steel. George M. Smith and Alvin A. Claassen, Chicago, Ill.

1,491,935—Fleshing Machine. Albertus Travis, Johnstown, N. Y.

1,491,944—Process of Producing Chromic-Acid Solutions. Arthur W. Burwell, Poughkeepsie, N. Y.

1,491,964—Art of Casting Metal Slabs. Egbert Moxham, Great Neck, N. Y., assignor to Conley Tinfoil Corporation, New York.

1,491,998—Motor Fuel. Thomas Midgley, Jr., Dayton, Ohio, assignor, by mesne assignments, to General Motors Research Corporation.

1,492,016—Method of Obtaining Metallic Compounds from Silicates. Charles McCombie Brown, Toronto, Ont., Canada.

1,492,027—Protective Coating Composition. Henry A. Gardner, Washington, D. C.

1,492,034—Process of Effecting Chemical Reactions With Byproduct Carbon from Cellulose Purification. Charles B. Jacobs, Wilmington, Del., assignor to E. I. du Pont de Nemours & Co., Wilmington.

1,492,038—Furnace Electrode. Johann Emil Leonarz, Tacubaya, Mexico.

1,492,051—Process of Mordanting and Dyeing Wool. Francis C. Telen, Penns Grove, N. J., assignor to E. I. du Pont de Nemours & Co., Wilmington, Del.

1,492,054 — Naphthionindoxyls and Process of Making Same. Richard Tobler and Robert Stocker, Basel, Jacob Muller, Munchenstein, near Basel, and Armin Bucher, Basel, Switzerland, assignors to Society of Chemical Industry in Basle, Basel, Switzerland.

1,492,063—Process and Apparatus for Producing Oxygen and Nitrogen in a State of Purity from Atmospheric Air.

1,492,086-87 — Electrical Smelting Emile Augustin Barret, Paris, France. Furnace. Jabea F. Shawhan, Dayton, Ohio, assignor of one-half to Perle L. Sagebiel, Dayton, Ohio.

1,492,094—Process for the Treatment of Aromatic Materials and Products Resulting Therefrom. Elias Bielouss, Washington, D. C., assignor of one-half to the Institute of Industrial Research, Inc., Washington, D. C., one-fourth to Willis A. Gibbons and one-fourth to James B. L. Orme, both of New York, N. Y.

1,492,102—Grinding Beater. Nicolay Nelson, Waukegan, Ill., assignor to Blatchford Calf Meal Co., Waukegan.

1,492,110 — Anthracene Dye and Process of Making Same. Harold T. Stowell, Buffalo, N. Y., assignor to National Aniline & Chemical Co., Inc., New York.

1,492,116—Device for Separating Dust from Gases. Robert Balmer, Toronto, Ont., Canada.

1,492,121-22—Electrolytic Cell. Frederick V. D. Cruser and Carl Clemens Haferkamp, Oswego, N. Y., assignors to the Diamond Match Co., Chicago, Ill.

1,492,143—Method of and Furnace for Annealing. Charles R. Stevens, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co.

1,492,155 — Insulating Material and Method of Forming Same. Arthur L. Brown, Wilkinsburg, Pa., assignor to Westinghouse Electric & Manufacturing Co.

1,492,165—Process for Drying Casein Curd. Ernest Foster, North Brunswick, Victoria, Australia, assignor to Vermont Casein Pty. Ltd., Melbourne.

1,492,168—Process of Refining Sugar-Cane Juice. Cyrus Howard Hapgood, Nutley, N. J., assignor to the De Laval Separator Co., New York.

1,492,179 — Apparatus for Shaping Sheet Pyroxylin and the Like. Earl R. Person, Leominster, Mass., assignor to the Viscoloid Co.

1,492,184—Method of Treating Colloidal Clay. James W. Weir, Fillmore, Calif., and John C. Black, Destrehan, La.

1,492,192—Material for the Cementation or Casehardening of Iron and Steel. John A. Baumgardner, Detroit, Mich.

1,492,193-94—Method of Producing Hydrocyanic Acid. Carl Beindl, Frankfort-on-the-Main, Germany.

1,492,230—Process for Working Zinc. Walter M. Towne, Brooklyn, N. Y., assignor by direct and mesne assignments, to E. W. Bliss Co., New York.

1,492,241 — Method of Recovering Scrap Battery Plates. Campbell C. Carpenter, Niagara Falls, N. Y., assignor to U. S. Light & Heat Corporation, Niagara Falls.

1,492,282 — Process for Recovering Values from Metal-Bearing Solutions. Frederick Mark Becket and Alexander L. Feild, New York, N. Y., assignors to Union Carbide & Carbon Research Laboratories, Inc.

1,492,283 — Process for Recovering Values from Metal-Bearing Solutions. Frederick Mark Becket, New York, N. Y., assignor to Union Carbide & Carbon Research Laboratories, Inc.

1,492,302—Electrode. John R. MacMillan, La Salle, N. Y., assignor to Niagara Alkali Co., Niagara Falls, N. Y.

1,492,305—Process and Apparatus for Decomposing Hydrocarbon Oils and Water and Recomposing the Products Therefrom. John Lester Murrie, New York, N. Y.

1,492,367—Soluble Solidified Coal-Tar Derivative Disinfectant. Axel France-Philipson, Chicago, Ill.

1,492,379 — Paper-Making Machine. Herman L. Kutter, Hamilton, Ohio.

1,492,389-90 — Wood Grinder. Paul Priem, Heidenheim, Germany, assignor to American Voith Contact Co., Inc., New York, N. Y.

1,492,391—Process and Apparatus for Handling Chlorine. Howard S. McQuaid, Edgewood, Md., and Roy C. Mitchell, East Woodbury, N. J.

1,492,399—Device for Closing Bottom Doors of Vertical Coking Chambers or Vertical Retorts in Coke Ovens and the Like. Josef Schafer, Dortmund, Germany.

1,492,404 — Refinishing Composition. John E. Smith, Philadelphia, Pa., assignor to Thomson Wood Finishing Co., Philadelphia.

1,492,408—Waterproofing Composition. Pearl E. Ulirich, Chicago, Ill.

1,492,412—Alloy Wrought Iron and Method of Making the Same. James Aston, Pittsburgh, Pa., assignor to A. M. Byers Co., Pittsburgh.

1,492,418—Drying Apparatus. Hermann Bogaty, Philadelphia, Pa., assignor to Proctor & Schwartz, Inc., Philadelphia.

1,492,476—Powdered Soap and Method of Making Same. Jakob Lund and Hermann Hausamann, Fredriksted, Norway, assignors to De Nordiske Fabriker, Christiania, Norway.

1,492,499—Mechanical Sugar Sprayer. William P. Weber, White Castle, La.

Complete specifications of any United States patent may be obtained by remitting 10c. to the Commission of Patents, Washington, D. C.

News of the Industry

Summary of the Week

Tariff Commission has ordered a second public hearing in connection with its investigation into production costs of casein.

The Committee on Military Affairs of the House reports that favorable legislation for helium program is essential to the national defense.

The duty on nitrite of soda has been increased from 3c. to 4½c. per lb., in accordance with flexible provisions of tariff act.

German chemists are reported to be working with a view of developing new poison for control of boll weevil.

Gustavus Ober, president of the National Fertilizer Association, discusses fertilizer industry before Senate Committee on Agriculture.

Union Carbide Co. makes supplementary bid for Muscle Shoals and offers minimum guarantee of $120,000,000 to U. S. Government.

Imports of coal-tar dyes through the port of New York were smaller in April than in the preceding months of this year.

British and German interests have not abandoned plans for working agreement in manufacture of dyes.

Favorable Action Expected for Helium Bill

The Military Affairs Committee of the House of Representatives has reported favorably and urges that the House pass the bill dealing with the production and utilization of helium. The legislation is believed by the Military Affairs Committee to be essential to the national defense and to the encouragement of commercial aviation.

While the bill itself simply authorizes the helium program, the committee calls attention to the fact that an appropriation of $5,000,000 will be necessary to carry the measure into effect. The prospects are that the House will pass the bill during the week of May 12. By the time of its passage it is expected that a favorable report will have been made by the Senate Military Affairs Committee, thus paving the way for the passage of the bill at this session, should Congress adjourn on June 7, as now planned.

"This proposed legislation," says the House Military Affairs Committee in its report, "is designed to secure for government use, especially for the army and navy, a supply, both for current use and for reserve, of helium, a non-flammable balloon gas found in various parts of the United States. The value of this gas in aviation is now beyond dispute, the successful flights of the 'Shenandoah' and other ships of the army and navy having demonstrated beyond doubt its unique value. With slightly less lifting power than hydrogen, it has the important qualities of being fireproof and of such a nature that after having been contaminated in use it can be repurified and rejuvenated. As a practical matter, hydrogen when contaminated is thrown away, the danger involved in repurifying it being too great to warrant the work.

"Helium has been studied and experimented with by this government since 1917. The experimental stage now has been largely traversed. There are known and adequate supplies. Processes of production have been so perfected that the cost is but a small fraction of that obtaining before the government took up the work.

"Helium is, so far as present knowledge extends, practically a monopoly of the United States. Its great value for war use is such that its export, except under the permission of the President, acting on the advice of the three departments concerned, is forbidden."

The legislation is to be administered by the Bureau of Mines, but ample provision is made in the bill for cooperation on the part of the War and Navy Departments.

German Chemists Study Boll Weevil Control

The German dye cartel is showing great activity in connection with the study of boll weevil control. Some are of the opinion that this indicates that the German chemists think they have made a discovery that can be applied in boll weevil control. Others think the Germans, realizing the commercial importance of any chemical that would prove more effective than calcium arsenate, simply have set themselves to the task.

There is no tendency to discount the possibilties in this connection. Chemists responsible for salvarsan, for Bayer 205 and for a long list of other remarkable chemical achievements are thoroughly capable of developing some poison which would be effective in the control of the boll weevil. It is thoroughly recognized that no single chemical development would be in a position to capture a more important financial prize.

Tariff Commission Will Hold Casein Hearing

On the basis of a new investigation of costs of production in this country and in Argentina, the Tariff Commission has ordered a second public hearing in connection with its inquiry into casein to be held June 23.

It developed at the first hearing, held last fall, that the question of costs regarding whole milk should be considered if possible and in December the commission ordered a further investigation, sending agents to the Argentine and to plants in this country.

A summary of information issued by the commission for the use of interested persons in connection with its June hearing suggests three methods of comparing the cost of skimmed milk used in making casein in Argentina and in this country: (1) That the value varies with the value of whole milk, which, however, is determined primarily by the price of butter; (2) allocate the cost of whole milk on the ratio of the sales value of casein and butter alone, and (3) allocate the cost of whole milk to casein in the ratio that the sales value of casein bears to the sales value of all products produced from the whole milk.

The last method would appear to be indicated as preferable in the summary of information. This subject will be argued at the public hearing.

Under method 1, the summary shows that the production and marketing costs of casein in 1922, figuring Argentine costs as c.i.f. New York, without duty, was $0.1017, United States, and $0.0675, Argentina; under method 2, $0.1375, United States, and $0.1108, Argentina; under method 3, $0.1157, United States, and $0.1108, Argentina.

The investigation into casein is the result of an application for a decrease in duty filed under the flexible tariff.

Union Carbide Co. Enlarges Bid for Muscle Shoals

Offers Minimum Guarantee of $120,000,000—Committee Hears Exposition of Ford Offer

A minimum guarantee of $120,000,000 to the U. S. government from dam No. 2 and nitrate plants at Muscle Shoals and an agreement to manufacture urea are outstanding features of a new proposal for a 50-year lease to Muscle Shoals submitted to Secretary of War Weeks by the Union Carbide Co. of New York. The proposals of the company contemplate leasing all the Muscle Shoals property from the government and the company guarantees to observe all the provisions of the federal water-power act.

Besides the $120,000,000 guarantee and the fertilizer proposal, the Carbide offer contemplates the development of a manufacturing center at Muscle Shoals where other products will be manufactured. In addition to the hydro-electric power needed for the manufacture of fertilizer and other products of the company, the bidders will make available additional superpower for distribution throughout the South for industrial, agricultural and home uses.

In addition to reserving 50,000 hp. for the manufacture of fertilizer at nitrate plant No. 2 at cost plus 5 per cent, the company agrees to spend 2½ per cent or one-half of the 5 per cent in research and development work to improve, cheapen and develop suitable and economical fertilizer processes to be utilized at plants 1 and 2. If a commercial process is developed or acquired adaptable to plant No. 1 then the company agrees also to manufacture fertilizer at that plant likewise at cost plus 5 per cent, and of that profit the company will spend one-half in further experimental work or in "an amortization fund for the amortization of the investment of the United States in nitrate plants 1 and 2."

Exposition of Ford Offer

Early in the week the Senate Committee on Agriculture had heard an exposition of the Ford offer by W. G. Waldo, secretary and consulting engineer of the Tennessee River Improvement Association, which supports this bid. Mr. Waldo dealt at length with the fertilizer situation.

A letter from Henry Ford has been received by the committee in which the Detroit manufacturer declined to send a representative before the committee to elaborate further upon his offer for Muscle Shoals on the ground that it has been fully explained and nothing could be accomplished by further testimony. The letter added that Chairman Norris' implied criticisms of President Coolidge in connection with Muscle Shoals was another reason why Mr. Ford declined to send a representative before the committee. E. G. Liebold, private secretary to Mr. Ford, earlier in the week had told the committee that messages sent Mr. Ford by newspaper correspondents purporting to give information of the President's attitude were sent without request and without authority to act in such matters.

Major-General C. C. Williams, chief of the ordnance department of the army, gave the committee an analysis of the various offers reduced to virtually comparable terms of 50 years in which he showed the return to the government under the Ford offer to be $115,906,896; under the power companies' offer, $134,909,320; under the Hooker offer, $113,274,738, and under the original bid of the Union Carbide Co. for part of the plants, $36,574,200.

General Williams told the committee that the production of ammonium nitrate has reached the point where the War Department would have no fear of lack of a supply in the event of war. He ventured the opinion that within 20 years all necessity of retaining control of Muscle Shoals from the standpoint of national defense will have passed.

F. J. Metzger Re-elected President of Chemists Club

The annual meeting of the Chemists Club, New York, was held May 7, at the club rooms, 52 East 41st St. Officers for the ensuing year were elected as follows: President, F. J. Metzger; resident vice-president, Allen Rogers; non-resident vice-president, E. R. Weidlein; secretary, Herbert G. Sidebottom; treasurer, A. G. Robinson; trustees, R. T. Baldwin and R. B. Moore.

Honorary membership was conferred on Brigadier-General Amos A. Fries and Francis P. Garvan. The proposal to raise the membership dues for both resident and non-resident members failed to receive the necessary two-thirds votes of the members present. The whole matter of club finances and facilities will be reviewed by a committee and submitted to the members for action at a special meeting to be called at an early date.

Increased Output of Natural Sodium Compounds in 1923

The production of natural sodium compounds in the United States in 1923 amounted to 59,440 short tons, valued at $1,775,940, according to reports made by producers to the Geological Survey. These figures show an increase of about 31 per cent in quantity and 25 per cent in value over those for 1922. The materials marketed were sodium carbonate (soda ash) and sodium bicarbonate from Cartago and Keeler, Calif.; hydrated sodium carbonate (sal soda) from Green River, Wyo.; sodium sulphate (salt cake) from McKittrick, Calif.; hydrated sodium sulphate (glaubers salt) from Casper, Wyo.; sodium borate (borax) from Trona, Calif.; and trona (a double salt of sodium carbonate and sodium bicarbonate) from Cartago and Keeler, and Trona, Calif. The output of trona in 1923 amounted to 13,110 tons, valued at $114,190. This quantity was about 7 per cent less than that produced in 1922.

The output of boron minerals in 1923 amounted to 129,400 short tons, valued at $3,988,770 at the point of shipment, an increase of 52 per cent in quantity and 47 per cent in value over the output in 1922. The minerals produced were borax (sodium borate) from Trona, Calif., and colemanite (calcium borate) from Death Valley Junction and Lang, Calif., and from Las Vegas and Moapa, Nev.

It is reported that the exploitation of deposits of sodium salts may soon be undertaken at Clarkdale, Ariz. (sodium sulphate); Owens Lake, near Lone Pine, Calif. (sodium carbonate); Westend, Calif. (borax); Muroc, Calif. (sodium sulphate); Shonkin Sag, Mont. (sodium sulphate); Wabuska, Nev. (sodium sulphate); and near Alamagordo, N. M. (sodium sulphate).

April Imports of Dyes at New York

The imports of coal-tar dyes for April, 1924, through the port of New York, totaled 174,880 lb., with an invoice value of $182,253. In addition, 1,670 lb., valued at $1,536, was reported through the port of Boston. According to figures of the Bureau of Commerce, imports at New York show the following comparisons:

	Lb.	Value
January	228,743	$232,571
February	158,874	176,657
March	293,862	302,016
April	174,880	182,253

Fertilizer Industry Defended by President Ober

A general defense of the commercial fertilizer industry against imputations that it is not taking advantage of the most efficient methods was placed before the Senate Committee on Agriculture, considering offers for Muscle Shoals, by Gustavus Ober, of G. Ober & Sons, Baltimore, speaking as president of the National Fertilizer Association, May 7.

Defending the fertilizer industry against the charge that it does not favor higher concentrates, Mr. Ober declared there are limits beyond which concentration cannot be carried as a practical proposition. Farm dilution is both difficult and inefficient, he declared, and there also is loss in plant food efficiency if high concentrates are carried over from season to season on the farm. Speaking of nitrate plant No. 2 at Muscle Shoals, Mr. Ober asserted that the production of ammonium nitrate is chemically possible but that it is not practicable as fertilizer ingredient; that ammonium sulphate can be produced, but that there already is an exportable surplus produced in this country, and that cyanamide may be eliminated from consideration. The farmers expect to get the equivalent of Chilean nitrate, but he said they will be disappointed in this and predicted a reaction against the producers at Muscle Shoals. The fertilizer industry objects to monopolistic control at Muscle Shoals, Mr. Ober said, and favors a lease whereby moderate blocks of power will be distributed among many industries. The fertilizer industry is not operating in restraint of trade, Mr. Ober protested in reply to questions from the committee members.

Mr. Ober assailed the tariff duty on ammonium sulphate, amounting to $5 per ton, and in this he was joined by many members of the committee.

Washington News

Import Duty on Nitrite of Soda Increased

A proclamation increasing the duty on sodium nitrite from 3 cents per pound to 4½ cents per pound under the terms of the flexible tariff was issued May 6 by President Coolidge. The new duty will become operative in 30 days. This is the second proclamation issued under the flexible tariff, the first having been in the case of wheat and wheat products.

The President acted after having referred the question of propriety of action to the Attorney-General and having received an opinion that action would be proper. This question was raised because of a suit against the Tariff Commission instituted by the Norwegian Nitrogen Products Co., New York selling agents for Norwegian producers of sodium nitrite, to compel the commission to disclose costs of production in the domestic industry. The lower courts upheld the commission in this case, but the President raised his question because an appeal is possible.

The increase granted in the duty on sodium nitrite is equivalent to 50 per cent of the duty named in the 1922 tariff act, and therefore is the maximum permitted by the law.

Application for the increase was filed more than a year ago by the American Nitrogen Products Co., of Seattle, Wash., on the ground that imports from Norway were destroying the domestic industry. The commission conducted an investigation both here and in Norway and held a public hearing on the subject. Its report, indicating that the maximum increase was justified, was unanimous.

Will Amend Misbranding Bills

Testifying before the House Interstate Commerce Committee in relation to the Rogers and Barkley misbranding bills, H. B. Thompson, of Washington, counsel of the Proprietary Association, asked amendment so as to exclude labels and products which come within the pure food and drugs act and the insecticide act. As the terms of the Rogers and Barkley bills are broad, Mr. Thompson said some overlapping of authority might result unless the amendment was inserted. The committee apparently viewed the request with favor.

Potash Production in 1923

In 1923 the United States produced 39,029 short tons of crude potash salts, containing 20,215 short tons of K_2O, according to a report of the Geological Survey. Of this output 32,254 short tons of crude potash, containing 17,982 short tons of K_2O, was produced from mineral sources—natural brines and dust from cement mills and blast furnaces—and 6,775 short tons of crude potash, containing 2,233 short tons of K_2O, was produced from organic sources—molasses distillery waste and beet sugar refinery water. This output was made by eight companies operating twelve plants in California, Indiana, Maryland, Nevada and Pennsylvania.

Sales and stocks on hand were reported by several companies that produced no potash in 1923. The quantity sold, as reported by eight companies, operating eleven plants, amounted to 35,164 short tons of crude potash, containing 19,281 short tons of K_2O, and was valued at $784,671. The stocks on hand Dec. 31, 1923, as reported by ten companies, operating fourteen plants, amounted to 34,794 short tons of crude potash, containing 12,363 short tons of K_2O.

Imports of crude potash into the United States in 1923 amounted to 748,101 short tons, containing 209,581 short tons of K_2O, valued at $15,354,755. Of this amount 712,441 short tons of crude potash, containing 194,079 short tons of K_2O, valued at $10,624,475, was salts used mainly in the fertilizer industry.

Decline in Sale of White Lead in 1923

The sale of white and sublimed lead in 1923 declined about 15 per cent as compared with 1922. The decrease in quantity sold was coincident with an increase in price of about 25 per cent. The sale of lead oxides, on the contrary, increased about 25 per cent in 1923 in spite of an increase in price of nearly 25 per cent. The quantity of zinc oxide sold in 1923 was practically the same as in 1922 although the price increased about 5 per cent. The sale of lithopone, on the other hand, showed an encouraging increase, nearly 18 per cent, and an increase in price of 7 per cent. Figures of Geological Survey offer following comparisons of quantities marketed and of values:

	1922	
	Short Tons	Value Total
Sublimed lead:*		
White	13,765	$1,829,865
Blue	972	129,230
Red lead	30,509	5,104,290
Orange mineral	370	83,022
Litharge	58,261	8,892,172
White lead:		
Dry	41,598	5,785,165
In oil	153,393	29,728,230
Zinc oxide	128,465	17,994,704
Leaded zinc oxide	19,613	2,251,601
Lithopone	83,360	9,214,040
Zinc chloride	41,627	2,009,147
Zinc sulphate	5,078	251,528

* Includes basic sulphate lead.

Conversion of Clay to Aluminum Sulphate

For some months past, investigators attached to the Berkeley, Calif., experiment station of the Bureau of Mines have studied the problem of the conversion of clay to aluminum sulphate. A special study of the dissolutions of clays in various strengths of sulphuric acid and at various temperatures has been made. Different clays show quite large individual differences in their reaction with acid. The different types of material so far tested include: California fireclays, an Idaho kaolin, a Georgia kaolin, a Missouri diaspore, a California bentonite, a Dakota bentonite, and a Utah alunite. A fullers earth from Florida was also tested, but was too low in alumina to be considered. During the present fiscal year liquid sulphur dioxide and water in sufficient proportion to make a strong sulphurous acid will be tested under pressure and heat for decomposing clays, as it promises to be much easier to purify the solutions and recover aluminum oxide from the aluminum sulphite solution than is possible with sulphuric acid and aluminum sulphate solutions.

Prohibition Bureau Control of Industrial Alcohol Opposed

While the Judiciary Committee of the House has thrown a sop to the chemical industry by amending its prohibition bureau bill so as to provide a division of industrial alcohol and chemistry within the proposed bureau, the amendment in no way removes the industry's primary objection to the legislation. The amendment reads:

> To better effectuate the provisions of section 13, Title III, of this act, there shall also be in said bureau a division of industrial alcohol and chemistry, the chief of which shall be a graduate chemist and a person of knowledge and experience in the manufacture, distribution, and industrial uses of ethyl and denatured alcohol, who shall be appointed by the Secretary of the Treasury and receive a salary of not more than $7,500 per annum. Such division of industrial alcohol and chemistry shall administer the manufacture, distribution, sale, and use of ethyl and denatured alcohol for all nonbeverage purposes in such manner as to insure an ample supply and promote the use thereof in scientific research and the development of lawful industry.

The amendment in no way changes the existing situation. There is a division of industrial alcohol in the prohibition unit as at present constituted. It is in charge of J. M. Doran, a chemist of ability and thoroughly sincere in his personal desire to remove all possible handicaps from the legitimate use of alcohol. It is so obvious that the Prohibition Commissioner and his immediate subordinates have as their principal objective the elimination of the maximum possible amount of alcoholic beverages that it is hoped by the industry that Congress will not consent to the committee's plan of placing industrial alcohol under the prohibition bureau. It would be just as sensible, representatives of the industry state, for the chief of police to regulate banking because money is an essential to wrong-doing. If the prohibition interests, it also is contended, are successful in establishing this absolute control over chemical and other activities dependent upon alcohol as a necessary material, their next step will be to extend their authority to the production of corn and molasses, so as to prevent the diversion of these materials into the manufacture of alcoholic beverages.

The committee in its report makes no reference to the determined character of the opposition to the measure as revealed at its hearings. The report says nothing as to the high standing of the men who appeared in opposition to the bill or the vast interests they represent. The committee apparently is so certain that the House will accept its bill that little effort was made in the report to explain the measure or recite the benefits that are expected to result from the legislation the committee is proposing.

News in Brief

Carbon Monoxide From Explosives Being Investigated—The argument is advanced that all types of permissible explosives produce about the same amount of carbon monoxide when used in mining coal. Apparently, according to the claims, it is the oxidation of the coal as much as of the explosive that determines the CO formation. If this be the case, the advantage always claimed for class A explosives, as compared with class B or class C, would not be justified. The evidence on this subject seems to be so well founded that the Bureau of Mines is making an investigation of the matter in its Pittsburgh laboratories.

Chemical Society and Chemistry Teachers in Joint Meeting—The New England Association of Chemistry Teachers and the Connecticut Valley Section of the American Chemical Society had a joint meeting in Holyoke, Mass., and at Mount Holyoke College, South Hadley, Mass., May 3. The members met in Holyoke and were conducted through the mills of the Whiting Paper Co., after which the party left for South Hadley, where Prof. A. J. Hopkins of Amherst College made an address on "Egypt, the Land of the Alchemist." Following dinner at the College Inn, a meeting of the Connecticut Valley Section of the American Chemical Society was held. The evening program included an address by Colonel M. T. Bogert, of Columbia University, on "Science and Art in the Perfume Industry."

New Cellulose Plant—The new plant of the American Cellulose & Chemical Co., at Cumberland, Md., is expected to be completed by June 1, according to an announcement made by R. N. Candless of the company. Three of the nine units have been completed and the six others are practically finished. The company is also completing work on a new water-pumping station in connection with its new plant.

Spectrophotometer Measures the Strengths of Dyes—The Bureau of Standards finds that in some cases the ordinary method of determining the two factors of strength and quality by comparing dyeings made from a standard of known value with dyeings made from the dye being tested can be omitted and an estimate of the strength of the dye secured by measuring with a spectrophotometer the light transmitted through the solution. This method was tried with the dye chromotrope 10B and the results given were found to agree well with those obtained with the practical dyeing test. The method does not show the small variations in hue and brightness that are given by the dyeing test, but does show the larger variations of quality.

World's Largest Sugar Refinery to Be Enlarged—The cane sugar refinery of the Californian & Hawaiian Sugar Refining Corporation, at Crockett, near San Francisco, is to be enlarged at a cost of $1,500,000. The present plant was built in 1906, being the result of a reconstruction of a beet-sugar refinery, but containing new and modern equipment. It now ranks as the largest and most up-to-date plant of its kind in the world, with a rated capacity of 2,200 tons per day of refined products.

Calcium Carbide Exports of Canada—During the fiscal year ended March, 1924, Canada exported 199,824 cwt. of calcium carbide valued at $762,860, which was a decrease of 390,721 cwt. and $1,595,300 compared with the previous fiscal year. In the 11 months ended February, 1924, which is the latest period for which details are available, the shipments of calcium carbide to the United States totaled 93,750 cwt., valued at $351,185, a falling off of 315,888 cwt. and $1,315,404 in value. The next important customer was Mexico, which took 27,323 cwt., valued at $108,713, an increase of 8,356 cwt. and $34,103 in value.

Tour of Mining Districts—Under the direction of Prof. Howard Eckfeldt, director of the mining department, Lehigh University, Bethlehem, Pa., arrangements are being perfected for a tour in which forty students of the mining engineering course at the institution will participate. The party will travel by automobiles, with route totaling 3,000 miles. It will leave the college about Aug. 1. Points to be visited include the coal fields of Pennsylvania; salt mines and glass plants in New York State; abrasive and electrometallurgical plants at Niagara Falls; gold and silver mines in the Cobalt and Kirkland Lake district of Canada; nickel deposits in Sudbury, Ont., Canada; Marquette, Mich., iron ore district; lead and zinc properties in the northern Mississippi Valley; bituminous coal fields of Illinois; limestone quarries of Indiana and the pottery, oil and coke industries of western Pennsylvania and Ohio.

Tire Plants Active—Tire-manufacturing plants in the Akron, Ohio, district are now averaging about 110,000 tires per day, or practically the high point attained just a year ago. This aggregate output is also close to the highest production peaks in the boom period.

Will Install Electric-Operated Dumps—The Amalgamated Sugar Co. is perfecting plans for the early installation of electric-operated sugar beet dumps at its mills at Paul and Heyburn, Idaho. It is expected that there will be a pronounced saving in handling the estimated production of 7,000 acres of sugar beets during the 1924 season.

Development of Arsenic Deposit—Development of the property of the Wellington Arsenic Co. at Wellington, N. S., is to be undertaken at once and the prospects appear to be exceedingly promising. A sample taken out weighed 1,000 lb., and when assayed is said to have showed 43.7 per cent metallic arsenic.

"Lumnite" Produced Here

American Manufacture of Alumina Cement Announced—Properties of the Material

An announcement of unusual interest to engineers is that alumina cement, for many years a commodity of importance in France, is now manufactured in this country. The Atlas Aluminate Cement Co., a company allied with the Atlas Portland Cement Co., has placed the material on the market after 9 months experimental operating in a plant at Northampton, Pa.

The material has been creating an ever-increasing interest since the war brought American engineers in touch with the French product. Essentially it is 40 per cent alumina, 40 per cent lime, 15 per cent iron oxides and 5 per cent silica, magnesia, etc.

The material is made from bauxite by a process that is not inexpensive. It therefore can hardly be regarded as a substitute or a competitor of portland cement. No matter how greatly the manufacturing cost is reduced, the requirement of a high-grade aluminum ore as raw material would prevent it from ever reaching a price parity with portland cement. Bauxite is not a widely distributed commodity.

Unusual Because It Is Quick Setting

Nevertheless it will fill a useful niche in the industrial scheme of things. It has two unique properties. The most important is its unusual setting time. Where portland cement requires 28 days in which to attain a satisfactory strength, alumina cement, or Lumnite cement as it is to be called in this country, reaches a greater strength in 24 hours. Obviously this makes possible a number of far-reaching developments. In highway construction a road can be repaired in a day, whereas with portland cement a long tie-up was necessary in order to permit the cement to become hard. In building work concrete forms may be taken off in 2 or 3 days and a saving in lumber for forms is possible.

The second property of significance is its resistance to chemical attack. In France authorities agree that it is unaffected by sea water or by sulphate-bearing ground waters. This may make the material of value in paper mill work and as a material of construction for coolers, scrubbers and towers in chemical plants. Certainly it is safe to report that the material gives promise in these fields and will undoubtedly be investigated.

Goodrich Company Merges With English Concern

According to advices from Akron, O., the B. F. Goodrich Co. has merged with the Ajax Tire Co. of Lancashire, England. The latter plant will be used to manufacture both tires and mechanical goods. Financing of the purchase involving approximately £900,000 is being done in England. The plant employs at capacity approximately 3 000. The purchase was made to supply the growing demand for English made tires in England.

Intelligent Legislation Needed as a Business Tonic

National Chamber of Commerce Urges Congress to Reconsider Stand on Mellon Plan and Soldier Bonus

The stand of American business on the fate of the Mellon tax plan, the soldier bonus and other problems of national moment was expressed in no uncertain terms by the Chamber of Commerce of the United States in annual meeting at Cleveland, Ohio, May 6, 7 and 8. President Julius Barnes concluded his summary of the year's economic progress with an earnest appeal for Congress to reconsider its action in discarding "the matured recommendation of a public servant of great experience and ability as to the wise point in the surtax rate which will produce more national revenue and yet stimulate industry and employment." He characterized the accepted rate of 40 per cent as "manifestly the product of the obstinacy of untested individual opinion or of partisan consideration." The so-called progressives who have joined with the radicals in defeating the Mellon plan were urged to change their stand before the present hesitancy in business spreads into unemployment and the recession of industry is felt in the American home.

The councilors of the National Chamber, in passing a resolution calling on the President to veto the proposed soldier bonus on both economic and moral grounds, confirmed the view that the present disturbed condition of business was largely due to the general distrust of the sincerity of Congress as well as its competency to pass on the vital legislation now awaiting its action. The anti-bonus resolutions were offered by Meyer Rothschild, national councilor.

The committee on taxation, headed by James R. MacColl, recommended that a joint commission should be formed from representatives of both houses of Congress and of the public to make a thorough study of federal taxes, simplication of the law for the income tax and improvement in its administration.

Marketing Census Needed

A high spot in the program of the group discussing domestic distribution was the address of F. M. Feiker, vice-president of the Society for Electrical Development, who urged the necessity for a census of marketing. He pointed out that we are now supplied with adequate information about production activities as far as numbers of plants and workers are concerned, but we do not know accurately in any trade how many wholesalers and retailers there are. Until we have these simple facts we can never talk quantitatively about distribution costs nor will we have an intelligent measure of marketing possibilities. These statistics are the most vital of all to industry and Mr. Feiker urged that steps be taken to encourage their collection by a reputable agency.

In the election of national councilors on May 8, seventeen nationally known business men of the chamber were named. Among the number were Ernest T. Trigg, president of John Lucas & Co., Philadelphia, Alvan T. Simonds, president of Simonds Saw & Steel Co., Fitchburg, Mass., and John M. Crawford, president of Parkersburg Rig & Reel Co., Parkersburg, W. Va.

Board of Trade for German-American Commerce

A Board of Trade for German-American Commerce, Inc., has been organized with headquarters in New York, for the purpose of re-establishing and furthering commercial relations between the United States and Germany.

The organization is being extended to comprise the entire United States, with branches in all important centers. It will be in close co-operation with the existing Chambers of Commerce and similar organizations throughout the United States and Germany.

The board solicits applications for membership from responsible firms and individuals interested in the furthering of trade and the strengthening of business relations between the United States and Germany. Jarvis W. Mason, vice-president of the American Surety Co. of New York, is president. Among the board of directors are August Eimer, president of Eimer & Amend; Hans Hinrichs, president of the Hans Hinrichs Chemical Corporation, and Herman A. Metz, president of H. A. Metz & Co.

Trade Notes

The annual meeting of the Paint, Oil and Varnish Club of New York will be held at the Hotel Biltmore on the evening of Thursday, May 15. Charles Cason, vice-president of the Chemical National Bank, will speak. Officers for the 1924-1925 club year will be elected, as well as delegates and alternates to the Atlantic City convention of the National Paint, Oil and Varnish Association.

J. H. R. Products Co., manufacturers of barium peroxide and chemical products at Willoughby, Ohio, have closed their plant, which has been in continuous operation for the past eight years.

It is announced from Canada that a franchise has been granted to the Canadian Petroleums, Limited, for permit for carbon black manufacture at Peace River, Alberta, covering leases on some 50,000 acres.

Not since October, 1920, have the Canadian exports of paper and woodpulp reached the value of the March shipments to outside countries. For March the value of paper was $10,604,573, and of pulp $4,115,650, a total of $14,720,223. This was an increase of $3,773,024 over February of this year, and the highest since October, 1920, when prices were considerably higher than at present.

Ault & Wiborg, manufacturers of colors and dyes, have sold their plant in Jersey City.

A. A. Cone is now in charge of the tanning materials department of the Sherlow Chemical Co. Mr. Cone formerly was connected with Marden, Orth & Hastings.

Financial

The directors of the Botany Worsted Mills have declared a dividend of 3 per cent on its capital stock, payable on May 1.

The Standard Plate Glass Corp. for quarter ended March 31, 1924, reports net earnings of $432,425 after depreciation, taxes, etc. After deducting dividends and sinking fund on prior preference stock the balance was $310,425, equivalent to $1.55 a share on the 200,000 shares of no-par outstanding common stock.

The Mathieson Alkali Works, Inc., for quarter ended March 31, 1924, reports net income of $93,258 after depreciation but before federal taxes, equivalent to $3.27 a share on outstanding $2,838,200 preferred stock on which accumulated dividends amount to 3½ per cent.

Profits of the Commercial Solvents Co. in the first three months were over $350,000, sufficient to pay full year's dividends on $1,000,000 8 per cent preferred, and on the 40,000 shares of A stock on a $4 basis, besides paying the $3 in back dividends due on the A stock. This is at the annual rate of about $25 a share on the 40,000 shares B stock.

A federal court order has been issued, authorizing the employment of L. L. Summers & Co. of New York, to make a survey of the business of the Virginia-Carolina Chemical Co., in order that the best methods may be applied and that a reorganization movement may be aided.

Synthetic Ammonia Plant Will Operate in France

A report from Paris says that the big powder factory which was set up at Toulouse during the war is to be converted into a nitrogen factory with aid of German experts from Badische Anilin and Soda Fabrik. The French government entered into an agreement with the above in 1919, by which the Badische company was to receive a lump sum of 5,000,000 francs and royalty on every ton of ammonia produced. Credit of 30,000,000 francs was approved by the French Parliament some time ago to start job of converting the Toulouse factory but it will not be finished for three years.

British-German Dye Negotiations Not Abandoned

Negotiations between the British Dyestuffs Corporation and the German cartel by no means have been abandoned, according to the latest information from abroad. There is full determination on the part of those sponsoring the movement to put it through. Apparently they are biding their time quietly until the storm of popular opposition has subsided. There is reason to believe that the Labor government in Great Britain favors the plan and doubt is expressed that the opposition to it in Parliament is in a position to block the proposal.

Men You Should Know About

Prof. ROGER ADAMS, of the University of Illinois, is recovering slowly from a very serious illness and will be able to resume his full duties in the fall.

OVERTON F. BOYD, a graduate of the sugar school of the Louisiana State University, has been appointed sugar technologist at the Imperial College of Tropical Agriculture, Trinidad, British West Indies.

Prof. J. B. CONANT, of Harvard University, will lecture at the summer school of the University of California.

MORTIMER H. HEYMAN, treasurer of the Barnet Leather Co., Inc., New York, with tannery at Little Falls, N. Y., has left for an extended trip to Europe and will be absent for a number of weeks. He will make a tour of the Continent.

Dr. JOEL H. HILDEBRAND, dean of men, University of California, addressed the Southern California Section of the American Chemical Society at Pomona College, Claremont, Calif., on May 2, his subject being "The Chemistry of Surfaces."

Dr. DORSEY A. LYON, assistant director of the Bureau of Mines, is inspecting the work at the Bartlesville, Minneapolis and Columbus experiment stations of the bureau.

BRIAN MEAD, who was graduated from the Imperial College of Science and Technology, London, in 1921, has joined the staff of the Research Laboratory of Applied Chemistry, Massachusetts Institute of Technology, Cambridge, Mass.

H. L. MINER is in the operating department of the California Ink Co., Berkeley, Calif.

D. T. SCHULTZ is general superintendent and technical director of the New England Oil Refining Co., Fall River, Mass.

Dr. SAMUEL W. STRATTON, president of the Massachusetts Institute of Technology, Cambridge, will deliver the oration at Harvard's Phi Beta Kappa exercises at Commencement in June.

ARTHUR T. UPSON, chief of the section of industrial investigations of the U. S. Forest Products Laboratory, Madison, Wis., has tendered his resignation, effective June 30, to join the staff of the National Lumber Manufacturers Association. His duties with the latter will be to assist the various regional associations and to co-operate with the lumber trade and lumber consumers in introducing and developing the new national lumber standards which go into effect on July 1.

HENRY R. VALLEZ, general superintendent of the Columbia Sugar Co., Bay City, Mich., has left for France, to be absent about 2 months. He will make a number of special tests and experiments at the Say Refineries while in that country. Mr. Vallez is the inventor of the Vallez rotary filter press.

R. P. WHITELAW, a chemical and mining engineer of note, has returned to Johannesburg, South Africa, after many years absence. In 1915 he went to England at the request of the Ministry of Munitions and was entirely responsible for the manufacture of mustard gas on a large scale. In 1917 he was appointed superintendent of his Majesty's factory at Avonmouth, England. He returns to South Africa to resume his practice as consulting chemical and mining engineer.

I. EDMUND WAECHTER has resigned as metallurgical engineer with the Brown & Sharpe Manufacturing Co., Providence, R. I., and is now engaged in a similar capacity with the General Chemical Co., 40 Rector St., New York, N. Y.

C. F. WILLARD is president of the Willard Rubber Products Co., Inc., with offices at 1340 Kettner Blvd., San Diego, Calif. The company has been organized to operate the Willard patents for the devulcanizing of vulcanized rubber.

GEORGE D. WILLETTS has become connected with the Pittsburgh Plate Glass Co., in charge of the refractories department at the Charleroi, Pa., plant, effective May 1. He was recently superintendent at the Pittsburgh, Pa., plant of the Willetts Clay Pot Co.

At a recent meeting of the American Zinc Institute Arthur E. Pendelari, vice-president of the Picher Lead Co., Joplin, Mo., was elected president; Howard Young was re-elected treasurer and F. S. Tuthill was re-elected secretary.

At a meeting of the Glass Container Association the following officers were elected: F. F. FERGUSON, of the Illinois Glass Co., Alton, Ill., president; A. F. BRADY, Hazel-Atlas Glass Co., Wheeling, W. Va., first vice-president; P. I. HEUISLER, Maryland Glass Corporation, Mount Winans, Md., second vice-president, and R. E. WALKER, Upland Flint Bottle Co., Upland, Ind., secretary and treasurer.

Calendar

AMERICAN ASSOCIATION OF CEREAL CHEMISTS, Curtis Hotel, Minneapolis, Minn., June 9 to 14.

AMERICAN CERAMIC SOCIETY, summer meeting and tour, July 21 to Aug. 18.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS, Denver, Colo., July 15 to 18.

AMERICAN LEATHER CHEMISTS ASSOCIATION, Spring Lake, N. J., June 18 to 20.

AMERICAN PAPER AND PULP MILL SUPERINTENDENTS ASSOCIATION, Dayton, May 22 to 24.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, Cleveland, Ohio, May 26 to 29.

AMERICAN SOCIETY FOR STEEL TREATING, Moline, Ill., May 22 to 23.

AMERICAN SOCIETY FOR TESTING MATERIALS, Atlantic City, June 23 to 28.

CANADIAN INSTITUTE OF CHEMISTS, Queens University, Kingston, Ont., May 27 to 29.

MANUFACTURING CHEMISTS ASSOCIATION, annual meeting, India House, New York City, June 4.

NATIONAL ASSOCIATION OF PURCHASING AGENTS, Boston, May 19 to 24.

NATIONAL FERTILIZER ASSOCIATION, Kenilworth Inn, Asheville, N. C., June 9 to 14.

NATIONAL FIRE PROTECTION ASSOCIATION, annual meeting, Atlantic City, N. J., May 13 to 15.

NATIONAL LIME ASSOCIATION, White Sulphur Springs, W. Va., May 20 to 23.

SOCIETY FOR PROMOTION OF ENGINEERING EDUCATION, Boulder, Colo., June 25 to 28.

WORLD POWER CONFERENCE, London, June 30 to July 12.

Obituary

Dr. HEINRICH OSCAR HOFMAN, professor of metallurgy at the Massachusetts Institute of Technology, died at Cambridge, Mass., on April 28. Dr. Hofman had a paralytic stroke in the spring of 1920, but had been able to get about until last winter, though with increasing difficulty. For 3 weeks before his death he had been confined to his bed. Dr. Hofman's book "Metallurgy of Lead and the Desilverization of Base Bullion," issued in 1882, was one of the earliest books published by *Engineering & Mining Journal*. It ran through numerous editions with minor revisions until Dr. Hofman revised it fully for inclusion in his Metallurgical Series in 1918. This Metallurgical Series consisted of three exhaustive works, "General Metallurgy," "Metallurgy of Copper," and "Metallurgy of Lead." Ill health prevented Dr. Hofman from completing his volumes "Metallurgy of Gold and Silver" and "Metallurgy of Minor Metals." Arrangements, however, have been made for the completion of his "Metallurgy of Iron and Steel." For nearly 30 years Dr. Hofman contributed annually a review of technical progress in lead smelting to *Mineral Industry*. Dr. Hofman was made honorary member of the American Institute of Mining Engineers in 1921, and professor emeritus, M.I.T., in 1922. He had not been able to do any professional work since his retirement.

Dr. Heinrich Oscar Hofman

Market Conditions

Market Prices for Chemicals Continue to Show Downward Tendency

Sharp Decline in Weighted Index Number—Lower Prices Bring About Moderate Improvement in Buying

THE weighted index number of *Chem. & Met.* underwent a material decline as a result of price changes in chemical products during the past week. Reductions were reported in some of the selections which have a relatively high weighted value and declines in important allied materials added to the weakness reported in the strictly chemical list. Lower price schedules were regarded as adjustments to meet reduced production costs and in most cases the changes resulted in the establishment of healthier trading conditions.

Conditions in manufacturing industries are not changing materially and contract commitments continue to supply the greater part of present needs for chemicals and other raw materials. Demand for small lots was said to be better and in some quarters new business was reported to be encouraging. There is very little call, however, for anything except prompt and nearby deliveries and no active trading movement is looked for before the end of summer.

One of the important developments of the week consisted in the announcement that the import duty on nitrite of soda had been raised by 50 per cent, which is the maximum permissible under the flexible provisions of the tariff act. This is the first decisive action taken in the matter of tariff changes on chemicals and has caused considerable speculation in trade circles regarding probable changes in the duties on other chemicals on which tariff investigations have been made.

Arrivals of chemicals from foreign markets were of smaller volume last week but, with few exceptions, offerings of foreign-made goods are ample and holders are competing with sellers of domestic goods. Receipts of arsenic are noted with regularity and the position of this market is said to depend largely on future buying of calcium arsenate. At present both arsenic and arsenate are dull with prices unstable.

Acids

Consumption of citric and tartaric acids is reported to have gained in volume and buyers have been in the market for additional lots. Prices have held a steady course. Lactic acid has been moving freely with no new developments. The lower price schedule recently put into effect on acetic acid has drawn a little more interest to that commodity but most sellers say the buying movement is far from active. Technical grades of phosphoric acid are easy under slow demand but the higher grades are in a firm position. Oxalic acid has been slow and the prices quoted show a range according to seller. The general tone is easy and domestic producers of oxalic have continued their policy of meeting quotations named for the imported. Formic acid is dull and prices are barely steady.

Formaldehyde Lower in Price —Nitrite of Soda Higher— Nitrate of Potash Reduced— Arsenic Dull and Easy—Permanganate of Potash Firmer —Yellow Prussiate of Potash Firmly Held—Sal Ammoniac Easier—Caustic Potash Steady

Mineral acids have not changed for the better and most selections are in large supply with the result that buyers are in a position of advantage.

Potashes

Bichromate of Potash — Export demand has not been active and trading for domestic account is along routine lines. It is reported that on large lots sellers would be willing to offer concessions but the market does not appear to be under selling pressure and no change has been made in the quoted prices of 9½c. to 9¾c. per lb.

Caustic Potash — This material is holding a firm course and cables from abroad do not indicate any departure from the firm position of last week. Spot material is quoted at an inside figure of 6¾c. per lb. and up to 7c. per lb. is asked in some quarters. While it is possible that 7c. per lb. could be shaded on a firm bid for shipment from the other side, the general asking price is 7c. per lb.

Permanganate of Potash—Holders of spot supplies of imported permanganate were higher in their views. At the close of the week the quotation had been advanced to 14½c. per lb. and domestic grades also were quoted at that figure. Stocks have been reduced by recent trading and strong markets abroad have influenced values for the imported and also have tended to lessen competition among sellers.

Prussiate of Potash—Red prussiate has held an easy course and buyers can do 35c. per lb. in some quarters. Yellow prussiate is strongly held and sales of moderate sized amounts were put through at 18½c. per lb. in the spot market. In spite of reports of offerings at 18c. per lb. and under buyers say they could secure no goods at such prices and 18½@19c. per lb. appears to be established as the trading basis.

Potash Sorts—Consumers have shown very little interest in this material and the slow buying movement has given an easy tone to values. While 8c. per lb. is generally quoted it is stated that bids of 7¾c. per lb. would find sellers.

Sodas

Bichromate of Soda—The position of some of the large consuming industries has not improved during the week and consumption of bichromate for the first 4 months of the year has been under the totals for the corresponding period last year. This is true, however, of most chemicals and bichromates have been unusually steady in price. The fact that contract prices to dealers were around current levels has served to eliminate competition from that quarter and producers have been in control of the market. Asking prices remain at 7½c. per lb. and upward on a quantity basis.

Caustic Soda—Reports of price cutting, especially on jobbing lots, have been prevalent and serve to disturb the market. Sellers say reports of sales at concessions have reached them but they say this practice is not general. New business is not heavy and the greater part of present movement is connected with contract deliveries. Prices heard for export last week ranged from 2.95c. to 3.05c. per lb., the range depending on seller. Contract prices hold at 3.10c. per lb. for carlot shipments at works.

Nitrite of Soda—This material has been featured by an advance of 50 per cent in import duty. The former duty was 3c. per lb. and the new rate, which will become effective in 30 days, levies a duty of 4½c. per lb. on importations. It is expected that the higher protection will give an impetus to domestic production but there still is some doubt regarding the ability of the home product to compete with the foreign. The first effect of the tariff change was to strengthen the price of foreign nitrite. Sellers marked up the quotation to 8¾c. per lb. Large consumers are covered on contracts and it is stated that most of these contracts were placed on a duty paid basis so that the advance in duty must be absorbed by the seller.

Prussiate of Soda—Interest has not improved and no important business was reported during the interval. The lowest prices heard apply to imported material with 10@10½c. per lb. given as the quotation. Most sellers of do-

mestic prussiate are asking 11c. per lb. but this figure is too high to attract buyers. Forward positions of imported are offered at 9¼c. per lb.

Sulphide of Soda—Trading in line with the slow condition of consuming trades and large lots are not sought. Demand for small lots is spasmodic and prices are hardly on a steady basis. Sellers of domestic fused offer at 3.10c. per lb. with broken at 3.35c. per lb., f.o.b. producing centers. Crystal, single strength, has been offered at 1.90c. per lb. at works with spot holdings easy at 2¼c. per lb.

Soda Ash—Export call is of moderate proportions. Shipments abroad in March are officially placed at 2,076,300 lb. as compared with 2,420,934 lb. in March, last year. Domestic trading is quiet due largely to regular shipments against contracts, which are taking care of a large part of consuming requirements. Jobbing trade is irregular. The contract price for light ash is 1.25c. per lb. in bulk; 1.38c. per lb. in bags; and 1.63c. per lb. in bbl., carlots f.o.b. works.

Miscellaneous Chemicals

Alum—Imports of potash alum have been rather large and the weight of offerings brought about an easier price tone. Lump was generally quoted at an inside price of 3c. per lb. but as low as 2.85c. per lb. has been heard. ground was offered at 4¼@4⅜c. per lb. Ammonia alum also was quiet with 3¼c. per lb. and upward asked for lump.

Arsenic—Lack of buying has placed the market in a nominal position. It is a waiting game now to see if consumers of calcium arsenate will come in the market for supplies. Stocks of arsenic are reported to be large and selling pressure may develop if demand does not soon improve. Domestic arsenic has been quoted at 10c. per lb. Calcium arsenate is offered at 11c. per lb. in carlots at works but is not selling in any quantity and is practically in the same position as arsenic.

Formaldehyde—Further reductions in price went into effect at the beginning of last week. Carlots were offered at 10¼c. per lb. which represents a decline of ½c. per lb. from the previous selling price. Demand has been fairly good but stocks are said to be ample and production costs have been lowered, thus enabling producers to offer the finished product at more attractive figures.

Copper Sulphate—Moderate improvement reported in demand. Domestic makers quote different prices. In some directions 4.90c. per lb. represented the market, but offerings came out at concessions. Imported for shipment offered more freely and on prompt material it was possible to do 4.35c. per lb. Imported on spot nominal at 4.50c. per lb.

Epsom Salt — Imported technical material offered quite freely and prices barely steady at $1.15@$1.25 per 100-lb. There was no change in the domestic product.

Sal Ammoniac — Offerings from abroad increased and this brought with it a slightly easier feeling, with intimation that prices might be shaded on a bid. Spot imported was offered at 6½c. per lb., but scattered lots might have been picked up at 6⅜c. On shipment from the other side 6¼c. was openly quoted. Domestic sal ammoniac was quotably unchanged.

Sulphate of Ammonia — Scattered buying has been reported but the market is not active and producers have been eager to book orders. Values have been shaded in order to effect trades and $2.60 per 100 lb. has been quoted on export inquiries. Domestic consumers also are said to be able to buy at $2.60 per 100 lb., at works.

"Chem. & Met." Weighted Index of Chemical Prices

Base = 100 for 1913-14

This week	152.55
Last week	157.02
May, 1923	178.00
May, 1922	159.00
May, 1921	143.00
May, 1920	279.00
May, 1919	227.00
May, 1918	267.00

The decline in methanol, formaldehyde, ammonium sulphate and crude cottonseed oil brought out the reduction in the weighted index number. Linseed oil was advanced.

Alcohol

Producers announced a decline of 10c. per gal. in prices for methanol. The market has been rather easy for some time and the sharp downward revision in the selling schedule did not surprise consumers. Accumulation in supplies made it necessary to meet the views of buyers. Pure is now held at 80c. per gal., in tank cars, 82c. per gal., in drums, and 87c. per gal., in cooperage. On the 95 per cent grade 75c. is asked in carload lots, in drums, and 80c. per gal., in bbl. The 97 per cent grade is quoted at 77c. per gal., in drums, and 82c. per gal., in cooperage, carload lots.

Denatured alcohol was quotably unchanged, with the undertone steady. No. 1 special, 190 proof, held at 45½c. per gal., in drums, carload lots. Ethyl spirits settled at $4.81 per gal., in bbl., on the 190 proof, U.S.P. Butyl alcohol unchanged at 25@30c. per lb.

Coal-Tar Products

Production of Benzine Affected by Smaller Output of Coke—Refined Naphthalene Lower—Aniline Oil Steady

DEMAND for benzene has been less active, but because of the reduced output, stocks remain light and prices comparatively steady. The slump in new buying in the steel industry caused a general cut in the output of coke, which naturally affects production of crudes. In refined naphthalene, competition for business continues keen and lower prices were named in more than one direction. The call for aniline oil was moderate, but no selling pressure was apparent, scattered business passing at former prices. Phenol was available for nearby delivery at 26c. per lb., in drums, carload basis, with the undertone barely steady. Ammonium sulphate was reduced to $2.60 per 100-lb., works.

Imports of coal-tar dyes and other coal-tar products at New York during April amounted to 174,880 lb., which compares with 293,862 lb. in March and 158,874 lb. in February. The market for intermediates was inactive in the past week and prices for most items showed a wide range.

Aniline Oil and Salt—Trading routine only, but a steady undertone prevailed in producing circles. Sales at 16c. per lb., drums extra, carload basis. Aniline oil for red nominal at 40c. per lb. Aniline salt unchanged at 22@23c. per lb., according to quantity and seller.

Benzaldehyde—The market was unsettled on increased offerings of the technical grade, prices at the close ranging from 68@70c. per lb., in drums. Demand slow.

Benzene—With production curtailed, reflecting less activity in coke-oven operations, the market held on a rather steady basis. Demand for the motor fuel grade has slackened a little. Stocks in the hands of producers are just about equal to requirements. The 90 per cent grade held at 23c. per gal., and the pure at 25c. per gal., tank cars, f.o.b. works.

Creosote—According to official figures, the imports of creosote oil during March amounted to 2,028,841 gal., which compares with 5,170,004 gal. in March a year ago.

Naphthalene — Offerings continue large and the market for refined naphthalene was easy, lower prices obtaining on round lots for immediate shipment. Refined flake, white, was offered at 5@5¼c. per lb., carload lots, with intimation that the inside figure could be shaded on a firm bid. Chips closed at 4⅛@4⅜c. per lb., carload lots, f.o.b. works. Intermediate makers showed comparatively little buying interest in the market.

Phenol — U.S.P. phenol for nearby shipment from works offered at 26c. per lb., in drums, carload basis. Market was inactive and undertone rather easy. There was no change for the better in the market for crude.

Paranitraniline—Buying restricted to small lots and prices barely steady, ranging from 68@72c. per lb., immediate shipment.

Solvent Naphtha—Supplies moderate and market steady on all grades. Water white, tankcars, f.o.b. works, offered at 25c. per gal.

Vegetable Oils and Fats

Crude Cottonseed Lower— Linseed Oil Advances—Inquiry for Nearby Soya Bean Oil—Coconut Barely Steady— Tallow Firm

FURTHER weakness developed in the market for crude cottonseed oil, sales passing at lower prices. News from the convention of the Interstate Cottonseed Crushers Association, in session at New Orleans, was not encouraging and support from this quarter was lacking. Linseed oil was higher on an actual shortage of nearby material. China wood oil continued unsettled. Coconut oil was quotably unchanged, with sellers not forcing matters because of a rather steady market for copra. Inquiry developed for crude soya bean oil.

Cottonseed Oil—Crude cottonseed oil sold at 8¼c. per lb., tank cars, Texas and at 8⅜c. per lb., tank cars, Southeast, a drop of ¼c. for the week. At the close the undertone was easy and buyers' views were fully ¼c. per lb. below those of sellers. The market for refined oil on the Produce Exchange closed about 18 points net lower for the week, with trading in the different options restricted at all times. Estimates on April consumption were reduced and, with lard easy, and a rather dull cash trade in both oil and compound, longs showed no inclination to support the market. On Thursday May oil settled at 9.90c. per lb. bid and 10.25c. per lb. asked. The July option closed at 10.02@10.03c. per lb. Professional traders look for pressure in July oil before long, taking the stand that the South will have to liquidate sooner or later. Bleachable oil was nominal at 8¼@9c. per lb., tank cars, f.o.b. Texas common points. Lard compound in New York held at 11⅜@12¼c. per lb., according to brand. Private estimates on the cotton acreage forecast a gain of from 4 to 6 per cent in this year's plantings. The crop outlook continues favorable.

Corn Oil—Sales of crude oil were reported at 8⅜c. per lb., tank cars, f.o.b. point of production, with the undertone easier.

Coconut Oil—Sellers on the Pacific coast continued to quote Ceylon type oil at 7⅞@8c. per lb., tank cars, all positions. The steady position of copra discouraged selling at concessions. Manila copra sold in a fairly large way at 5c. per lb., c.i.f. Pacific coast ports. In New York Ceylon type oil settled at 8⅛c. asked, sellers' tanks, with intimation that some sellers stood ready to quote this figure f.o.b. buyers' plant.

Linseed Oil—Prompt shipment oil was advanced to 94c. per gal., carload lots, cooperage basis, a net gain of 4c. for the week. June shipment sold at 92c. early in the period, but later 94c. was asked by most sellers. One trader held out for 95c. on nearby oil. June-July settled at 92c. per gal., with the market more or less nominal in the absence of important trading in futures. Several crushers had virtually no oil to offer for May delivery and active bidding for nearby seed sent prices for the raw material higher in all of the leading markets. This, in turn, strengthened the position of oil. Crushers located in the New York district were called upon to ship oil to the West. The volume of new business booked was not large, but deliveries against existing contracts absorbed the bulk of the production. News from the Argentine received here early in the week was unfavorable, a strike retarding the movement of seed. Advices received later indicated that the strike had been settled. The crop outlook for the Northwest is favorable. Official acreage figures will not be available before July. The market for linseed cake for export was dull and prices nominal at $33.50 per ton, f.a.s. New York.

Lower Estimates on April Sales of Cottonseed Oil

Private estimates on consumption of refined cottonseed oil for the month of April now range from 152,000 to 170,000 bbl. Early in April there were estimates of 200,000 bbl. consumption, but business slackened in the second half of the month and the figures have been revised downward. Actual April consumption figures will be available late in May. Consumption of oil for the first 8 months, in bbl., with a comparison, follows:

	1923–24	1922–23
August	202,800	169,100
September	168,900	229,200
October	232,400	308,800
November	218,600	263,000
December	145,100	193,400
January	203,400	242,600
February	152,700	186,800
March	162,100	165,100
Total	1,486,000	1,758,000

China Wood Oil — May-June-July shipment from the Pacific coast in tank cars held at 12¾@13c. per lb. In New York spot oil was nominal at 14½@15c. per lb., in cooperage, carload basis. Demand was in evidence for nearby tanks.

Soya Bean Oil—May shipment from the Pacific coast sold at 9¾c. per lb., tank cars, duty paid. At the close 10c. was asked on nearby business, with June forward nominal at 9¾c. per lb., f.o.b. Coast. Paint makers showed buying interest.

Palm Oils—Market quiet. Niger offered for shipment at 6½@6⅝c. per lb., c.i.f. terms. Lagos offered at 7.15c. per lb., forward delivery, c.i.f. basis.

Olive Foots—Spot oil available at 9½@9¾c. per lb. Prime green for shipment quiet at 9¾c. per lb.

Rapeseed Oil—English refined afloat offered at 84c. per gal. June shipment from abroad nominal at 80@80½c. per gal.

Fish Oils—Herring oil offered at 40@45c. per gal., in bbl., Baltimore. Crude menhaden offered on "if made" basis of 50c. per gal., tanks, fish factory, but no buying interest reported.

Tallow, Etc.—Sales of extra special tallow again reported at 7½c. per lb., ex plant, with market steady. Yellow grease nominal at 6¾@7c. on low acid material. Oleo stearine nominal at 10¼@11c. per lb.

Miscellaneous Materials

Antimony — Lower prices prevailed for Chinese and Japanese antimony because of quiet trading. There were sellers at 8¾@9c. per lb. Cookson's "C" grade offered at 12½c. per lb. Chinese needle, lump, nominal at 8½@9c. per lb. Antimony oxide nominal at 9½@10c. per lb.

Barytes — Crude in Missouri unchanged at $8 per ton. Georgia producers quote $9 per ton, mines. White floated steady at $23@$24 per ton, f.o.b. St. Louis.

Blanc Fixe—Dry material available at 3¾c. per lb., in bbl., carload lots, f.o.b. point of production. Market steady.

Diatomaceous Earth—California producers quote $30 per ton, f.o.b. plant, on powder for insulation. Natural offered at $20 and calcined at $50 per ton. Brick, kiln fired, $60. Filtration powder, $30 per ton.

Glycerine—Sales of dynamite in the West at 16c. per lb., a decline of ¼c. Fair inquiry at this price. Chemically pure unsettled. Refiners asking 16¾@17c. per lb., New York, but inside figure might be shaded in some directions on a carload lot. Crude soaplye glycerine steady at 10½@10¾c. per lb., loose, carload basis. Saponification nominal at 12c. asked, loose.

Naval Stores—Moderate business in spirits of turpentine at 92½c. per gal., an advance of 1½c. for the week. Rosins in better request and prices steadied. On the lower grades prices ranged from $5.60@$5.70 per bbl. Some export inquiry reported.

Quicksilver—Recent advances checked buying, but prices held firm in all directions. Spot metal closed at $78@$79 per flask, with offerings at inside figure light.

Varnish Gums — Heavy arrivals resulted in price concessions. Demand moderate only. Batavian damar available on spot at prices ranging from 23½@24½c. per lb. Kauri No. 1 ranged from 59@67c. per lb., the style of package, etc., accounting for the wide spread in prices. Amber copal, Congo, nominal at 9@14c. per lb.

White Lead—Another reduction occurred in the price of the metal, pig lead settling at 7.50c. per lb., which compares with 8c. a week ago. The price is the lowest named by leading interests since Jan. 1. The decline brought out no change in the selling schedule for pigments. The market for white lead was easier in tone and consumers expect a reduction in prices. Standard dry white lead held at 10½c. per lb., in casks, carload lots.

Zinc Oxide—The zinc market was weak, but this did not change the situation in oxide. American process, lead free, held at 7½c. per lb., with the leaded grades commanding from 7@7½c. per lb. French process was quotably unchanged at 9¾c. per lb., for the red seal, 10¾c. per lb. for the green seal and 12c. per lb. for the white seal.

Imports at the Port of New York

May 2 to May 8

ACIDS—Cresylic—49 dr., Glasgow, E. H. Watson. **Hypophosphoric** — 2 carboys, Hamburg, Order. **Stearic**—63 bg., Rotterdam, Lamont, Corliss & Co. **Tartaric**—50 bbl., Antwerp, Order; 100 keg, Genoa, L'Appula Society.

ALCOHOL—100 bbl. denatured, Arecibo, C. Estevas; 23 bbl. do., St. Thomas, Lehn & Fink.

AMMONIUM NITRATE—528 csk., Hamburg, Kuttroff, Pickhardt & Co.

AMMONIUM CHLORIDE — 20 csk., Liverpool, Wing & Evans.

ANTIMONY—80 csk., Melbourne, Order.

ANTIMONY ORE—911 bg., Melbourne. Order.

ANTIMONY REGULUS—420 cs., Trieste, Brandeis, Goldschmidt & Co.

ARSENIC — 200 csk. white, Hamburg, Central Union Trust Co.; 200 cs., Antwerp, Order; 270 cs., Melbourne, Irving Bank-Col. Trust Co.; 66 csk., Melbourne, Order.

BORAX—750 bg., Antwerp, B. Drakenfeld & Co.

BRONZE POWDER — 21 cs., Bremen Baer Bros.; 18 cs., Bremen, Order.

CALCIUM CARBONATE — 200 bg., Bremen, Lehn & Fink.

CAMPHOR—150 cs., Rotterdam, G. W. Sheldon & Co.

CASEIN — 417 bg., Buenos Aires, National City Bank; 417 bg., Buenos Aires, International Acceptance Bank; 250 bg., Buenos Aires, Tradesmen's National Bank; 517 bg., Buenos Aires, Order.

CHALK — 900 bg. ground, Antwerp, Reichard-Coulston, Inc.; 2,350 bg., Antwerp, Brown Bros. & Co.; 250 bg., Antwerp, Order; 375 pkg., Bristol, H. J. Baker & Bro.; 1,000 bg. ground, Antwerp, Cooper & Cooper, Inc.; 360 bg., Antwerp, Order.

CHEMICALS—200 bg. and 40 csk., Hamburg, Order; 73 cs., Rotterdam, A. Klipstein & Co.; 5 cs., Hamburg, Elmer & Amend; 100 csk., Barcelona, Pomeroy & Fischer; 280 bg., Glasgow, Coal & Iron National Bank; 898 bg., Glasgow, Brown Bros. & Co.

CLAY — 488 tons, Bristol, Moore & Munger.

COAL-TAR DISTILLATE — 138 dr., Liverpool, Order.

COLORS — 3 pkg. aniline, Rotterdam, Grasselli Chemical Co.; 5 csk. dry, Hamburg, H. R. Jahn; 6 pkg., Hamburg, Kuttroff, Pickhardt & Co.

COPPER SULPHATE—100 csk., Bristol, Am. Hawaiian S. S. Co.

DIVI-DIVI—278 bg., Maracaibo, Standard Bank of South Africa.

FERROCHROMIUM — 65 csk., Gothenburg, C. Hardy, Inc.

FERROMANGANESE — 2,520 tons (in bulk), Sauda, E. J. Lavino & Co.

FULLERS EARTH—600 bg., London, L. A. Salomon & Bros.

GARNET ORE—4,900 bg., Almeria, H. Berk & Co.

GLYCERINE—100 csk. crude, Marseilles, Marx & Rawolle.

GRAPHITE—250 bg., Marseilles, Order; 125 bg., Barcelona Order.

GUMS—748 bg. copal, Antwerp, Order; 250 cs. damar, Batavia, France, Campbell & Darling; 400 cs. damar, Batavia, Order; 221 bg. and 577 bskt. copal, Macassar, S. Winterbourne & Co.; 449 bskt. and 142 bg. do., Macassar, Irving Bank-Col. Trust Co.; 65 pkg. copal, Macassar, Catz Am. Corp.; 1,315 bskt., 225 bg. and 66 cs. do., Macassar, Innes & Co.; 65 bskt. copal, Macassar Patterson, Boardman & Knapp; 60 bskt. do., Macassar, H. Uyeda & Co.; 125 bskt. and 483 bg. copal, Macassar, L. C. Gillespie & Son; 137 bskt. copal, Macassar, Order; 61 bskt., Macassar, Sino Java H'v'g., 300 cs. damar, Padang, Order; 150 cs. damar, Singapore, Manufacturers Trust Co.; 175 bg. do., Singapore, Baring Bros. & Co.; 280 bg. damar and 10 cs. copal, Singapore, Kidder, Peabody & Co.; 275 cs. damar, Singapore, Order; 126 cs. kauri, Auckland, Brown Bros. & Co.; 600 cs. do., Auckland, Baring Bros. & Co.; 700 cs. do., Auckland, Bank of New South Wales; 886 cs. do., Auckland, Order; 320 bg. yacca, Port Adelaide, Baring Bros. & Co.; 28 bg. copal, Antwerp, Order; 525 bg. karaya, Glasgow, Order.

INFUSORIAL EARTH—1,254 bg., Oran, Order.

IRON OXIDE — 23 csk., Antwerp, Reichard-Coulston, Inc.; 370 bg., Bristol, G. Z. Collins & Co.; 33 csk., Bristol, Reichard-Coulston, Inc.; 86 csk., Bristol, Order; 116 bbl., Malaga, Reichard-Coulston, Inc.; 228 bbl., Malaga, Am. Exchange Natl. Bank; 228 bbl., Malaga, C. J. Osborn Co.; 254 bbl., Malaga, S. L. Libby Corp.; 298 bbl., Malaga, C. K. Williams & Co.; 92 bbl., Malaga, A. E. Rittwagen; 144 bbl., Malaga, C. K. Williams & Co.

Opportunities in the Foreign Trade

Parties interested in any of the following opportunities may obtain all available information from the Bureau of Foreign and Domestic Commerce at Washington or from any district office of the bureau. The number placed after the opportunity must be given for the purpose of identification.

CHEMICALS. Caracas, Venezuela. Agency.—10,042.

CHEMICALS, heavy. Manchester, England. Agency.—10,052.

DYESTUFFS and industrial chemicals. Johannesburg, South Africa. Exclusive agency.—10,051.

PAINTS. Manchester, England. Agency.—10,052.

ROSIN. Hamburg, Germany. Purchase.—10,049.

ROSIN. Vienna, Austria. Purchase and agency.—10,050.

SALTPETER, 50,000 tons. Danzig. Purchase.—10,055.

SULPHUR, crude for explosives. Glasgow, Scotland. Purchase.—10,053.

SULPHUR, block. Hamburg, Germany. Purchase.—10,049.

TURPENTINE. Hamburg, Germany. Purchase.—10,049.

TURPENTINE. Vienna, Austria. Purchase and agency.—10,050.

LAMPBLACK — 150 csk., Antwerp, Y. Van Gritsen; 100 csk., Antwerp, F. B. Vandegrift & Co.; 40 csk., Antwerp, E. Bullock & Son.

LITHOPONE — 500 csk., Antwerp, B. Moore & Co.; 203 csk., Antwerp, E. M. & F. Waldo; 900 csk., Antwerp, B. Moore & Co.; 100 csk., Antwerp, Mills & Salter; 100 csk., Antwerp, E. M. & F. Waldo.

LOGWOOD—436,560 lb., Port au Prince, Stamford Dyewood Co.; 22 csk., Savannah La Mar, H. Campbell & Co.; 25 csk., Glasgow, American Dyewood Co.

MAGNESIUM CARBONATE — 20 cs., Liverpool, E. & J. Burke.

MAGNESITE—626 bg., Rotterdam, A. Kramer & Co.

MANGROVE BARK—500 bg., Singapore, Order; 4,000 bg., Singapore, Order.

NAPHTHALENE—1,678 bg., Antwerp, Order; 500 bg., Antwerp, E. Suter & Co.

OCHER—508 csk., Marseilles, Am. Exchange Natl. Bank; 133 csk., Marseilles, J. L. Smith & Co.; 19 csk., Marseilles, L. H. Butcher & Co.; 254 csk., Marseilles, Reichard-Coulston, Inc.; 50 csk., Marseilles, E. E. Marks Co.; 200 csk., Marseilles, F. B. Vandegrift.

OILS — **Cod** — 400 bbl., Bergen, Order. **Olive Oil Foots** (Sulphur Oil)—300 bbl., Messina, Order; 200 bbl., Palermo, Fourth Street National Bank, Philadelphia. **Palm** —80 csk., Rotterdam, African & Eastern Trading Co.; 63 bbl., Asahan, National City Bank. **Sesame**—10 csk., Marseilles, Order.

OIL SEEDS—**Copra**—968 bg., Trinidad, Order; 659 bg., Trinidad, Order. **Linseed** —23,976 bg., Buenos Aires, Spencer Kellogg & Sons; 52,694 bg., Rosario, Spencer Kellogg & Sons; 16,408 bg., Buenos Aires, National City Bank; 7,886 bg., Buenos Aires, L. Dreyfus & Co.; 66,282 bg. and 3,035,071 kilos (in bulk), Rosario, Spencer Kellogg & Sons.

PITCH—291 bbl., Hamburg, Order.

POTASSIUM SALTS — 100 bbl. alum, Rotterdam, Hans Heinrichs Chemical Corp.; 35 csk. bicarbonate, Rotterdam, E. M. Sergeant & Co.; 1,705 bg. muriate, Antwerp, Society Comm. des Potasses d'Alsace; 4,000 bg. muriate, Bremen, Potash Importing Corp. of America; 100 keg chlorate, Antwerp, E. Suter & Co.; 400 keg chlorate, Antwerp, Mechanics & Metals National Bank; 400 bg. nitrate, Antwerp, Order; 200 bg. muriate, Hamburg, Potash Importing Corp. of America; 1,500 bg. muriate, Bremen, Potash Importing Corp. of America; 35 cs. caustic, Gothenburg, Merck & Co.

PUMICE—11,596 bg. and 40 csk., Canneto Lipari, Order.

QUEBRACHO—989 bg., Buenos Aires, J. C. Andressen & Co.; 2,015 bg., Buenos Aires, Mechanics & Metals National Bank; 2,053 bg., Buenos Aires, National Bank of Commerce; 967 bg., Buenos Aires, Order.

QUICKSILVER — 500 flasks, Alicante, Italian Discount & Trust Co.; 275 flasks, Antwerp, Order.

SAL AMMONIAC—100 csk., Bristol, C. De P. Field & Co.; 100 bbl., Antwerp, E. Suter & Co.

SHELLAC—154 sk., Marseilles, Order; 10 cs., Hamburg, Rogers-Pyatt Shellac Co.

SILVER SULPHIDE—6 cs., Pacasmayo, W. R. Grace & Co.; 95 cs., Antofagasta, Watson, Geach & Co.

SODIUM SALTS — 201 csk. phosphate, Antwerp, Brown Bros. & Co.; 7,139 bg. nitrate, Antofagasta, Wessel, Duval & Co.; 13,486 bg. do., Iquique, A. Gibbs & Co.; 6,854 bg. do., Iquique, E. I. du Pont de Nemours & Co.; 14,077 bg. do., Iquique, Wessel, Duval & Co.; 80 dr. sulphite, Bristol, R. F. Downing & Co.; 80 csk. sulphite, Marseilles, Johnston & Sons; 21,403 bg. nitrate, Caleta Buena, W. R. Grace & Co.; 8,248 bg. nitrate, Antofagasta, W. R. Grace & Co.; 21,530 bg. nitrate, Iquique, W. R. Grace & Co.; 91 cs. cyanide, Barcelona, Order.

STARCH — 400 bg. potato, Rotterdam, Stein, Hall & Co.

TALC—400 bg., Genoa, Bankers Trust Co.; 500 bg., Genoa, Coty, Inc.; 300 bg., Genoa, C. Mathieu; 250 bg., Genoa, Order.

TARTAR — 39 bg., San Antonio, C. Pfizer & Co.; 245 sk., Marseilles, Tartar Chemical Works; 225 sk., Marseilles, C. Pfizer & Co.; 205 bg., Marseilles, C. Pfizer & Co.; 300 bg., Marseilles, Royal Baking Powder Co.; 289 bg., Oran, C. Pfizer & Co.

TURPENTINE SUBSTITUTE — 12 cs., Hamburg, Order.

UMBER — 200 bg. lump, Leghorn, Reichard-Coulston, Inc.

VANADIUM—2,400 bg., Callao, Vanadium Co. of Am.

WAXES—112 bg. beeswax, San Antonio, Bank of London & South America; 123 bg. do., San Antonio, Order; 112 bg. do., Valparaiso, Order; 1,000 bg. montan, Hamburg, Irving Bank-Col. Trust Co.; 47 bdl. beeswax, Caibarien, D. Steengrafe; 50 bg. carnauba, Bahia, National City Bank; 54 bg. beeswax, San Antonio, National Bank of Commerce; 33 bg. do., Talcahuana, W. R. Grace & Co.; 140 bg. do., Valparaiso, W. R. Grace & Co.; 101 bg. do, Valparaiso, Order.

WOOL GREASE—83 csk., Bremen, Order; 90 bbl., Antwerp, Order.

WHITING—2,000 bg., Antwerp, Order.

ZINC OXIDE — 75 csk., Antwerp, A. Klipstein & Co.; 50 bbl., Antwerp, Reichard-Coulston, Inc.

ZINC SALTS—43 csk., Antwerp, A. Klipstein & Co.

Current Prices in the New York Market

For Chemicals, Oils and Allied Products

THESE prices are for the spot market in New York City, but a special effort has been made to report American manufacturers' quotations whenever available. In many cases these are for material f.o.b. works or on a contract basis and these prices are so designated. Quotations on imported stocks are reported when they are of sufficient importance to have a material effect on the market. Prices quoted in these columns apply to large quantities in original packages.

General Chemicals

Acetone, drums, wks	lb.	$0.15 –	$0.15½
Acetic anhydride, 85%, dr.	lb.	.38 –	....
Acid, acetic, 28%, bbl.	100 lb.	3.12 –	3.37
Acetic, 56%, bbl.	100 lb.	5.85 –	6.10
Acetic, 80%, bbl.	100 lb.	8.19 –	8.44
Glacial, 99½%, bbl.	100 lb.	11.01 –	11.51
Boric, bbl.	lb.	.10 –	....
Citric, kegs	lb.	.45½–	.47
Formic, 85%	lb.	.12½–	.13
Gallic, tech.	lb.	.45 –	.50
Hydrofluoric, 52%, carboys	lb.	.11 –	.12
Lactic, 44%, tech., light, bbl.	lb.	.12½–	.13
22% tech., light, bbl.	lb.	.06 –	.06½
Muriatic, 18° tanks	100 lb.	.80 –	.85
Muriatic, 20°, tanks	100 lb.	.95 –	1.00
Nitric, 36°, carboys	lb.	.04 –	.04½
Nitric, 42°, carboys	lb.	.04½–	.05½
Oleum, 20%, tanks	ton	16.00 –	17.00
Oxalic, crystals, bbl.	lb.	.10½–	.10¾
Phosphoric, 50% carboys	lb.	.07 –	.08
Pyrogallic, resublimed	lb.	1.55 –	1.60
Sulphuric, 60°, tanks	ton	9.00 –	10.00
Sulphuric, 60°, drums	ton	13.00 –	14.00
Sulphuric, 66°, tanks	ton	14.00 –	15.00
Sulphuric, 66° drums	ton	19.00 –	20.00
Tannic, U.S.P., bbl.	lb.	.65 –	.70
Tannic, tech., bbl.	lb.	.45 –	.50
Tartaric, imp., powd., bbl.	lb.	.27 –	.28
Tartaric, domestic, bbl.	lb.	.30 –	....
Tungstic, per lb.	lb.	1.20 –	1.25
Alcohol, butyl, drums, f.o.b. works	lb.	.25 –	.30
Alcohol ethyl (Cologne spirit), bbl.	gal.	4.83 –	....
Ethyl, 190 p'f. U.S.P., bbl.	gal.	4.81 –	....
Alcohol, methyl (see Methanol)			
Alcohol, denatured, 190 proof			
No. 1, special bbl.	gal.	.51½–	...
No. 1, 190 proof, special, dr.	gal.	.45½–	...
No. 1, 188 proof, bbl.	gal.	.52½–	...
No. 1, 188 proof, dr.	gal.	.48½–	...
No. 5, 188 proof, bbl.	gal.	.50½–	...
No. 5, 188 proof, dr.	gal.	.44½–	...
Alum, ammonia, lump, bbl.	lb.	.03¼–	.04
Potash, lump, bbl.	lb.	.02½–	.03¼
Chrome, lump, potash, bbl.	lb.	.05½–	.06
Aluminum sulphate, com., bags	100 lb.	1.35 –	1.40
Iron free bags	lb.	2.35 –	2.45
Aqua ammonia, 26°, drums	lb.	.06½–	.06¾
Ammonia, anhydrous, cyl.	lb.	.28 –	.30
Ammonium carbonate, powd. tech., casks	lb.	.12 –	.13
Ammonium nitrate, tech., casks	lb.	.09 –	.10
Amyl acetate tech., drums	gal.	3.25 –	3.75
Antimony oxide, white, bbl.	lb.	.09½–	.10
Arsenic, white, powd., bbl.	lb.	.09½–	.10½
Arsenic, red, powd., kegs	lb.	.14½–	.15½
Barium carbonate, bbl.	ton	64.00 –	68.00
Barium chloride, bbl.	ton	88.00 –	90.00
Barium dioxide, 88%, drums	lb.	.17½–	.18
Barium nitrate, casks	...	.08 –	.08½
Blanc fixe, dry, bbl.	lb.	.03½–	.04
Bleaching powder, f.o.b. wks., drums	100 lb.	1.90 –	....
Spot N. Y. drums	100 lb.	2.25 –	2.35
Borax, bbl.	lb.	.05½–	.05¾
Bromine, cases	lb.	.28 –	.30
Calcium acetate, bags	100 lb.	3.00 –	3.05
Calcium arsenate, dr.	lb.	.11 –	.11½
Calcium carbide, drums	lb.	.05 –	.05½
Calcium chloride, fused, dr. wks.	ton	21.00 –	....
Gran. drums works	ton	27.00 –	....
Calcium phosphate, mono, bbl.	lb.	.06½–	.07½
Camphor, Jap. cases	lb.	.74 –	.75
Carbon bisulphide, drums	lb.	.06 –	.06½
Carbon tetrachloride, drums	lb.	.07 –	.07½
Chalk, precip.—domestic, light, bbl.	lb.	.04½–	.04¾
Domestic, heavy, bbl.	lb.	.03½–	.04
Imported, light, bbl.	lb.	.04½–	.05
Chlorine, liquid, tanks, wks.	lb.	.04½–	....
Contract, tanks, wks.	lb.	.04½–	....
Cylinders, 100 lb., wks.	lb.	.05½–	.07½
Chloroform, tech., drums	lb.	.30 –	.32
Cobalt, oxide, bbl.	lb.	2.10 –	2.25
Copperas, bulk, f.o.b. wks.	ton	16.00 –	18.00
Copper carbonate, bbl.	lb.	.16½–	.17
Copper cyanide, drums	lb.	.45 –	.46
Copper sulphate, dom., bbl., 100 lb.		4.80 –	4.90
Imp bbl.	100 lb.	4.50 –	4.60
Cream of tartar, bbl.	lb.	.20½–	.21½
Epsom salt, dom., tech., bbl.	100 lb.	1.75 –	2.00
Epsom salt, imp., tech., bags	100 lb.	1.10 –	1.20
Epsom salt, U.S.P., dom., bbl.	100 lb.	2.25 –	2.50
Ether, U.S.P., dr.	lb.	.14 –	.15
Ethyl acetate, 85%, drums	gal.	.95 –	....
Ethyl acetate, 99%, dr.	gal.	$1.10 –	....
Formaldehyde, 40%, bbl.	lb.	.10½–	.10½
Fullers earth—f.o.b. mines	ton	7.50 –	18.00
Furfural, works, bbl.	lb.	.25 –	....
Fusel oil, ref., drums	gal.	3.50 –	....
Fusel oil, crude, drums	gal.	2.50 –	2.75
Glaubers salt, wks., bags	100 lb.	1.20 –	1.40
Glaubers salt, imp., bags	100 lb.	1.00 –	1.05
Glycerine, c.p., drums extra	lb.	.16½–	.17
Glycerine, dynamite, drums	lb.	.16 –	.16½
Glycerine, crude 80%, loose	lb.	.10½–	.10¾
Hexamethylene, drums	lb.	.68 –	.75
Lead:			
White, basic carbonate, dry, casks	lb.	.10½–	....
White, basic sulphate, casks	lb.	.09½–	....
White, in oil, kegs	lb.	.12½–	....
Red, dry, casks	lb.	.12 –	....
Red, in oil, kegs	lb.	.13½–	....
Lead acetate, white crys., bbl.	lb.	.14½–	....
Brown, broken, casks	lb.	.13½–	....
Lead arsenate, powd., bbl.	lb.	.18 –	.20
Lime-Hydrated, bg, wks.	ton	10.50 –	12.50
Bbl., wks.	ton	18.00 –	19.00
Lime, Lump, bbl.	280 lb.	3.63 –	3.65
Litharge, comm., casks	lb.	.11½–	....
Lithopone, bags	lb.	.06½–	.06¾
Magnesium carb., tech., bags	lb.	.08½–	.08½
Methanol, 95%, bbl.	gal.	.80 –	....
Methanol, 97%, bbl.	gal.	.82 –	....
Methanol, pure, tanks	gal.	.80 –	....
drums	gal.	.82 –	....
bbl.	gal.	.87 –	....
Methyl-acetone, t'ks.	gal.	.80 –	....
Nickel salt, double, bbl.	lb.	.09½–	.10½
Nickel salts, single, bbl.	lb.	.10½–	.11
Orange mineral, csk	lb.	.14½–	.15½
Phosgene	....	.60 –	.75
Phosphorus, red, cases	lb.	.70 –	.75
Phosphorus, yellow, cases	lb.	.35 –	.40
Potassium bichromate, casks	lb.	.09½–	.09¾
Potassium bromide, gran., bbl.	lb.	.20 –	.32
Potassium carbonate, 80-85%, calcined, casks	lb.	.05½–	.06
Potassium chlorate, powd.	lb.	.07½–	.08½
Potassium cyanide, drums	lb.	.47 –	.52
Potassium, first sorts, cask	lb.	.07½–	.08
Potassium hydroxide (caustic potash) drums	lb.	.06½–	.07
Potassium iodide, cases	lb.	3.65 –	3.75
Potassium nitrate, bbl.	lb.	.06 –	.07½
Potassium permanganate, drums	lb.	.14½–	.14¾
Potassium prussiate, red, casks	lb.	.35 –	.38
Potassium prussiate, yellow, casks	lb.	.18½–	.19
Salammoniac, white, gran., casks, imported	lb.	.06½–	....
Salammoniac, white, gran., bbl., domestic	lb.	.07½–	.07½
Gray, gran., casks	lb.	.08 –	.09
Salsoda, bbl.	100 lb.	1.20	1.40
Salt cake (bulk) works	ton	18.00 –	20.00
Soda ash, light, 58% flat, bulk, contract	100 lb.	1.25 –	....
bags, contract	100 lb.	1.38 –	....
Soda ash, dense, bulk, contract, basis 58%	100 lb.	1.35 –	....
bags, contract	100 lb.	1.45 –	....
Soda, caustic, 76%, solid, drums contract	100 lb.	3.10 –	....
Soda, caustic, ground and flake, contracts, dr.	100 lb.	3.50 –	3.85
Soda, caustic, solid, 76% f. a.s. N. Y.	100 lb.	3.00 –	....
Sodium acetate, works, bbl.	lb.	.05 –	.05½
Sodium bicarbonate, bulk	100 lb.	1.75 –	....
330-lb. bbl.	100 lb.	2.00 –	....
Sodium bichromate, casks	lb.	.07½–	.07¾
Sodium bisulphate (niter cake)	ton	6.00 –	7.00
Sodium bisulphite, powd., U.S.P., bbl.	lb.	.04½–	.04¾
Sodium chlorate, kegs	lb.	.06½–	.07
Sodium chloride	long ton	12.00 –	13.00
Sodium cyanide, cases	lb.	.19 –	.22
Sodium fluoride, bbl.	lb.	$0.08½–	$0.10
Sodium hyposulphite, bbl.	lb.	.02½–	.02¾
Sodium nitrite, casks	lb.	.08½–	.08¾
Sodium peroxide, powd., cases	lb.	.28 –	.30
Sodium phosphate, dibasic, bbl.	lb.	.03½–	.03¾
Sodium prussiate, yel. bbl.	lb.	.10 –	.11
Sodium salicylic, drums	lb.	.38 –	.40
Sodium silicate (40°, drums)	100 lb.	.75 –	1.15
Sodium silicate (60°, drums)	100 lb.	1.75 –	2.00
Sodium sulphide, fused, 60-62% drums	lb.	.03½–	.03¾
Sodium sulphite, crys., bbl.	lb.	.02½–	.03
Strontium nitrate, powd., bbl.	lb.	.10 –	.10½
Sulphur chloride, yel drums	lb.	.04½–	.05
Sulphur, crude	ton	18.00 –	20.00
At mine, bulk	ton	16.00 –	18.00
Sulphur, flour, bag	100 lb.	2.25 –	2.35
Sulphur, roll, bag	100 lb.	2.00 –	2.10
Sulphur dioxide, liquid, cyl.	lb.	.08 –	.08
Tin bichloride, bbl.	lb.	.13½–	....
Tin oxide, bbl.	lb.	.55 –	....
Tin crystals, bbl.	lb.	.35 –	....
Zinc carbonate, bags	lb.	.14 –	.14½
Zinc chloride, gran, bbl.	lb.	.05 –	.05½
Zinc cyanide, drums	lb.	.36½–	.37
Zinc dust, bbl	1b.	.08 –	.08½
Zinc oxide, lead free, bag	lb.	.07½–	....
5% lead sulphate, bags	lb.	.07½–	....
10 to 35 % lead sulphate, bags	lb.	.07 –	....
French, red seal, bags	lb.	.09½–	....
French, green seal, bags	lb.	.10½–	....
French, white seal, bbl.	lb.	.12 –	....
Zinc sulphate, bbl.	100 lb.	3.00 –	3.25

Coal-Tar Products

Alpha-naphthol, crude, bbl.	lb.	$0.60 –	$0.65
Alpha-naphthol, ref., bbl.	lb.	.70 –	.75
Alpha-naphthylamine, bbl.	lb.	.35 –	.36
Aniline oil, drums	lb.	.16 –	.16½
Aniline salts, bbl.	lb.	.22 –	.23
Anthracene, 80%, drums	lb.	.75 –	.80
Anthraquinone, 25%, paste, drums	lb.	.75 –	.80
Benzaldehyde U.S.P., carboys	lb.	1.50 –	....
f.f.c. drums	lb.	1.60 –	....
tech, drums	lb.	68	.72
Benzene, pure, water-white, tanks, works	gal.	.25 –	....
Benzene, 90%, tanks, works	gal.	.23 –	....
Benzidine base, bbl.	lb.	.80 –	.82
Benzidine sulphate, bbl.	lb.	.70 –	.72
Benzoic acid, U.S.P., kegs	lb.	.82 –	85
Benzoate of soda, U.S.P., bbl.	lb.	.67 –	.72
Benzyl chloride, 95-97%, ref., carboys	lb.	.35 –	....
Benzyl chloride, tech., drums	lb.	.25 –	....
Beta-naphthol, tech., bbl.	lb.	.24 –	.25
Beta-naphthylamine, tech.	lb.	.65 –	.70
Cresol, U.S.P., drums	lb.	.23 –	.28
Ortho-cresol, drums	lb.	.28 –	.32
Cresylic acid, 97%, works drums	gal.	.65 –	.70
95-97%, drums, works	gal.	.60 –	.65
Dichlorbenzene, drums	lb.	.07 –	.08
Diethylaniline, drums	lb.	.53 –	.55
Dimethylaniline, drums	lb.	.36 –	.38
Dinitrobenzene, bbl.	lb.	.15 –	.17
Dinitrochlorbenzene, bbl.	lb.	.21 –	.22
Dinitronaphthalen, bbl.	lb.	.30 –	.32
Dinitrophenol, bbl.	lb.	.35 –	.40
Dinitrotoluen, bbl.	lb.	.18 –	.20
Dip oil, 25%, drums	gal.	.26 –	.28
Diphenylamine, bbl.	lb.	.50 –	.52
H-acid, bbl.	lb.	.72 –	.75
Meta-phenylenediamine, bbl.	lb.	.95 –	1.00
Michlers ketone, bbl.	lb.	3.00 –	3.50
Monochlorbenzene, drums	lb.	.08 –	.10
Monoethylaniline, drums	lb.	.95 –	1.10
Naphthalene, flake, bbl.	lb.	.05 –	.05½
Naphthalene, balls, bbl.	lb.	.06 –	.06½
Naphthionate of soda, bbl.	lb.	.60 –	.65
Naphthionic acid, crude, bbl.	lb.	.60 –	.62
Nitrobenzene, drums	lb.	.09 –	.09½
Nitro-naphthalene, bbl.	lb.	.25 –	.30
Nitro-toluene, drums	lb.	.13½–	.14
N-W acid, bbl.	lb.	1.00 –	1.05
Ortho-amidophenol, kegs	lb.	2.40 –	2.50
Ortho-dichlorbenzene, drums	lb.	.12 –	.13
Ortho-nitrophenol, bbl.	lb.	1.25 –	1.30
Ortho-nitrotoluene, drums	lb.	.11 –	.12
Ortho-toluidine, bbl.	lb.	.12 –	.13
Para-aminophenol, base, kegs	lb.	1.25 –	1.35
Para-aminophenol, HCl, kegs	lb.	1.45 –	1.60
Para-dichlorbenzene, bbl.	lb.	.17 –	.20
Paranitraniline, bbl.	lb.	.68 –	.70
Para-nitrotoluene, bbl.	lb.	.58 –	.60
Para-phenylenediamine, bbl.	lb.	1.40 –	1.50
Para-toluidine, bbl	lb.	.72 –	.80
Phthalic anhydride, bbl.	lb.	.30 –	.34
Phenol, U.S.P., dr.	lb.	.26 –	.27
Picric acid, bbl.	lb.	.20 –	.22
Pitch, tanks, works	ton	25.00 –	30.00
Pyridine, imp., drums	gal.	4.75 –	5.00
Resorcinol, tech., kegs	lb.	1.30 –	1.40

Resorcinol, pure, kegs	lb.	$2.00 –	$2.10
R-salt, bbl	lb.	.55 –	.60
Salicylic acid, teeh., bbl	lb.	.32 –	.33
Salicylic acid, U.SP., bbl	lb.	.35 –	..
Solvent naphtha, water-white, tanks	gal.	.25 –	....
Crude, tanks	gal.	.22 –	....
Sulphanilic acid, crude, bbl	lb.	.16 –	.18
Toluidine, bbl	lb.	1.00 –	1.05
Toluidine, mixed, kegs	lb.	.30 –	.35
Toluene, tank cars, works	gal.	.26 –	....
Toluene, drums, works	gal.	.30 –	....
Xylidine, drums	lb.	.48 –	.50
Xylene, pure, tanks	gal.	.40 –	....
Xylene, com., tanks	gal.	.28 –	....

Naval Stores

Rosin B-D, bbl. 280	lb.	$5.50 –	$5.60
Rosin E-I, bbl. 280	lb.	5.70 –	....
Rosin K-N, bbl. 280	lb.	5.90 –	6.10
Rosin W.G.-W.W., bbl. 280	lb.	7.00 –	7.60
Wood rosin, bbl. 280	lb.	5.80 –	5.90
Turpentine, spirits of, bbl	gal.	.92½ –	.93
Wood, steam dist., bbl	gal.	.85 –	.....
Wood, dest. dist., bbl	gal.	.67 –	.....
Pine tar pitch, bbl. 200	lb.	5.50 –	.....
Tar, kiln burned, bbl. 500	lb.	11.00 –	.....
Retort tar, bbl. 500	lb.	11.00 –	.....
Rosin oil, first run, bbl	gal.	.41 –	.....
Rosin oil, second run, bbl	gal.	.45 –	.....
Rosin oil, third run, bbl	gal.	.47 –	.....
Pine oil, steam dist	gal.	.63 –	.....
Pine tar oil, ref	gal.	.50 –	.....

Animal Oils and Fats

Degras, bbl	lb.	$0.03½ –	$0.05½
Grease, yellow, loose	lb.	.06½ –	.07
Lard oil, Extra No. 1, bbl	gal.	.85 –	.....
Lard compound, bbl	lb.	.11½ –	.12
Neatsfootoil 20 deg. bbl	gal.	1.28 –	.....
No. 1, bbl	gal.	.88 –	.92
Oleo Stearine		.11 –	.....
Oleo oil, No. 1, bbl	lb.	.13 –	.....
Red oil, distilled, d.p. bbl	lb.	.08½ –	.09½
Saponified, bbl	lb.	.08½ –	.09½
Tallow, extra, loose	lb.	.07½ –	.....
Tallow oil, acidless, bbl	gal.	.83 –	.....

Vegetable Oils

Castor oil, No. 3, bbl	lb.	$0.15½ –	.....
Castor oil, No. 1, bbl	lb.	.16 –	.....
Chinawood oil, bbl	lb.	.14½ –	.15
Coconut oil, Ceylon, bbl	lb.	.09½ –	.....
Ceylon, tanks, N.Y.	lb.	.08½ –	.....
Coconut oil, Cochin, bbl	lb.	.09½ –	.10
Corn oil, crude, bbl	lb.	.10½ –	.11½
Crude, tanks, (f.o.b. mill)	lb.	.08½ –	.09
Cottonseed oil, crude (f.o.b. mill), tanks	lb.	.08½ –	.08¾
Summer yellow, bbl	lb.	.10½ –	.10½
Winter yellow, bbl	lb.	.11½ –	.11½
Linseed oil, raw, car lots, bbl	gal.	.94 –	.....
Raw, tank cars (dom.)	gal.	.88 –	.....
Boiled, cars, bbl. (dom.)	gal.	.96 –	.....
Olive oil, denatured, bbl	gal.	1.25 –	1.30
Sulphur, (foots) bbl	lb.	.09½ –	.09¾
Palm, Lagos, casks	lb.	.07½ –	.07½
Niger, casks	lb.	.06½ –	.....
Palm kernel, bbl	lb.	.08½ –	.08¾
Peanut oil, crude, tanks (mill)	lb.	.11½ –	.....
Peanut oil, refined, bbl	lb.	.14½ –	.14½
Perilla, bbl	lb.	.14 –	.14½
Rapeseed oil, refined, bbl	gal.	.88 –	.90
Sesame, bbl	lb.	.11½ –	.11½
Soya bean (Manchurian), bbl.	lb.	.11½ –	.....
Tank, f.o.b. Pacific coast	lb.	.09½ –	.10
Tank, (f.o.b. N.Y.)	lb.	.10½ –	....

Fish Oils

Cod, Newfoundland, bbl	gal.	$0.62 –	$0.65
Menhaden, light pressed, bbl.	gal.	.60 –	.....
White bleached, bbl	gal.	.62 –	.....
Blown, bbl	gal.	.66 –	.....
Crude, tanks (f.o.b. factory)	gal.	.50 –	.....
Whale No. 1 crude, tanks, coast	lb.	..... –	.....
Winter, natural, bbl	gal.	.75 –	.76
Winter, bleached, bbl	gal.	.78 –	.79

Oil Cake and Meal

Coconut cake, bags	ton	$30.00 –	.....
Cottonseed meal, f.o.b. mills	ton	36.00 –	38.00
Linseed cake, bags	ton	33.50 –	34.00
Linseed meal, bags	ton	40.00 –	42.00

Dye & Tanning Materials

Albumen, blood, bbl	lb.	$0.50 –	$0.55
Albumen, egg, teeh, kegs	lb.	.95 –	.97
Cochneal, bags	lb.	.32 –	.34
Cutch, Borneo, bales	lb.	.04½ –	.04¾
Cutch, Rangoon, bales	lb.	.13½ –	.14½
Dextrine, corn, bags 100	lb.	3.64 –	3.91
Dextrine gum, bags 100	lb.	3.99 –	4.09
Divi-divi, bags	ton	40.00 –	42.00
Fustic, sticks	ton	30.00 –	35.00
Fustic, chips, bags	lb.	.04 –	.05
Gambier com., bags	lb.	.12 –	.12½
Logwood, sticks	ton	25.00 –	26.00
Logwood, chips, bags	lb.	.02½ –	.03
Sumac, leaves, Sicily, bags	ton	..... –	.....
Sumac, ground, bags	ton	160.00 –	165.00
Sumac, domestic, bags	ton	50.00 –	55.00
Starch, corn, bags 100	lb.	3.07 –	3.33
Tapioca flour, bags	lb.	.05½ –	.06½

Extracts

Archil, conc., bbl	lb.	$0.16½ –	$0.20
Chestnut, 25% tannin, tanks	lb.	.01½ –	.02½
Divi-divi, 25% tannin, bbl	lb.	.04 –	.05
Fustic, crystals, bbl	lb.	.20 –	.22
Fustic, liquid, 42°, bbl	lb.	.08 –	.09
Gambier, liq., 25% tannin, bbl.	lb.	.09½ –	.10
Hematine crys., bbl	lb.	.14 –	.18
Hemlock, 25% tannin, bbl	lb.	.03½ –	.04
Hypernic, solid, drums	lb.	.24 –	.26
Hypernic, liquid, 51°, bbl	lb.	.09½ –	.10½
Logwood, crys., bbl	lb.	.14 –	.15
Logwood, liq., 51°, bbl	lb.	.08 –	.09
Osage Orange, 51°, liquid, bbl.	lb.	.07 –	.08
Osage Orange, powder, bg	lb.	.14 –	.15
Quebracho, solid, 65% tannin, bbl	lb.	.05 –	.05½
Sumac, dom., 51°, bbl	lb.	.07 –	.07½

Dry Colors

Blacks–Carbongas, bags, f.o.b. works, contract	lb.	$0.09 –	$0.11
spot, cases	lb.	.12 –	.16
Lampblack, bbl	lb.	.12 –	.40
Mineral, bulk	ton	$35.00 –	45.00
Blues–Bronze, bbl	lb.	.38 –	.42
Prussian, bbl	lb.	.38 –	.42
Ultramarine, bbl	lb.	.08 –	.35
Browns, Sienna, Ital., bbl	lb.	.06 –	.14
Sienna, Domestic, bbl	lb.	.03½ –	.04
Umber, Turkey, bbl	lb.	.04 –	.04½
Greens–Chrome, C.P.Light, bbl	lb.	.28 –	.30
Chrome, commercial, bbl	lb.	.11½ –	.12
Paris, bulk	lb.	.26 –	.27
Reds, Carmine No. 40, tins	lb.	4.50 –	4.70
Iron oxide red, casks	lb.	.10 –	.16
Para toner, kegs	lb.	1.00 –	1.10
Vermilion, English, bbl	lb.	1.40 –	1.45
Yellow, Chrome, C.P. bbls	lb.	.16½ –	.17
Ocher, French, casks	lb.	.02½ –	.03

Waxes

Bayberry, bbl	lb.	$0.20 –	$0.21
Beeswax, crude, Afr. bg	lb.	.25½ –	.26
Beeswax, refined, light, bags	lb.	.32 –	.34
Beeswax, pure white, cases	lb.	.40 –	.41
Candelilla, bags	lb.	.23 –	.23½
Carnauba, No. 1, bags	lb.	.38 –	.39
No. 2, North Country, bags	lb.	.29 –	.30
No. 3, North Country, bags	lb.	.21 –	.22
Japan, cases	lb.	.25 –	.26
Montan, crude, bags	lb.	.05½ –	.06
Paraffine, crude, match, 105-110 m.p., bbl	lb.	.06 –	....
Crude, scale 124-126 m.p. bags	lb.	.05½ –	....
Ref., 118-120 m.p., bags	lb.	.05½ –	....
Ref., 123-125 m.p., bags	lb.	.05½ –	....
Ref, 128-130 m.p., bags	lb.	.06 –	....
Ref., 133-135 m.p., bags	lb.	.06½ –	....
Ref., 135-137 m.p., bags	lb.	.06½ –	.07
Stearic acid, sgle pressed, bags	lb.	.11 –	.11½
Double pressed, bags	lb.	.11½ –	.11¾
Triple pressed, bags	lb.	.13 –	.13½

Fertilizers

Acid phosphate, 16%, bulk, works	ton	$7.50 –	$7.75
Ammonium sulphate, bulk f.o.b. works 100	lb.	2.60 –	.....
Blood, dried, bulk	unit	4.10 –	4.15
Bone, raw, 3 and 50, ground	ton	26.00 –	28.00
Fish scrap, dom., dried, wks	unit	–	..
Nitrate of soda, bags 100	lb.	2.50 –	.....
Tankage, high grade, f.o.b. Chicago	unit	2.00 –	2.10
Phosphate rock, f.o.b. mines Florida pebble, 68-72%	ton	3.40 –	.....
Tennessee, 75%	ton	6.75 –	7.00
Potassium muriate, 80%, bags	ton	34.55 –	.....
Potassium sulphate, bags basis 90%	ton	45.85 –	.....
Double manure salt	ton	26.35 –	.....
Kainit	ton	7.22 –	.....

Crude Rubber

Para—Upriver fine	lb.	$0.20½ –	.....
Upriver coarse	lb.	.16½ –	.....
Upriver caucho ball	lb.	.17 –	.17½
Plantation—First latex crepe	lb.	.22½ –	.....
Ribbed smoked sheets	lb.	.21½ –	.....
Amber crepe No. 1	lb.	.21½ –	.....

Gums

Copal, Congo, amber, bags	lb.	$0.09 –	$0.14
East Indian, bold, bags	lb.	.16 –	.18
Manila, pale, bags	lb.	.18 –	.19
Pontinak, No. 1 bags	lb.	.19 –	.20
Damar, Batavia, cases	lb.	.23½ –	.24
Singapore, No. 1, cases	lb.	.28 –	.29
Singapore, No. 2, cases	lb.	.21 –	.21½
Kauri, No. 1, cases	lb	.60 –	.65
Ordinary chips, cases	lb.	.20½ –	.21½
Manjak, Barbados, bags	lb.	.08 –	.11

Shellac

Shellac, orange fine, bags	lb.	$0.56 –	....
Orange superfine, bags	lb.	.58 –	....
A. C. garnet, bags	lb.	.52 –	$0.53
Bleached, bonedry	lb.	.64 –	.65
Bleached, fresh	lb.	.53 –	.54
T. N., bags	lb.	.54 –	.55

Miscellaneous Materials

Asbestos, crude No. 1, f.o.b., Quebec sh. ton		$300.00 –	$400.00
Asbestos, shingle, f.o.b., Quebec sh. ton		50.00 –	70.00
Asbestos, cement, f.o.b., Quebec sh. ton		20.00 –	25.00
Barytes, grd, white, f.o.b. mills, bbl net ton		16.00 –	17.00
Barytes, grd., off-color, f.o.b. Balt net ton		13.00 –	14.00
Barytes, floated, f.o.b. St. Louis, bbl net ton		23.00 –	24.00
Barytes, crude f.o.b. mines, bulk net ton		8.00 –	8.50
Cascin, bbl., teeh lb.		.11 –	.12
China clay (kaolin) crude, No. 1, f.o.b. Ga net ton		7.00 –	8.00
Washed, f.o.b. Ga net ton		8.50 –	9.00
Powd., f.o.b. Ga net ton		14.00 –	20.00
Crude f.o.b. Va net ton		6.00 –	8.00
Ground, f.o.b. Va net ton		13.00 –	19.00
Imp., lump, bulk net ton		15.00 –	20.00
Imp., powd net ton		45.00 –	50.00
Feldspar, No. 1 f.o.b. N.C. long ton		7.00 –	7.50
No. 2 f.o.b. N.C. long ton		4.50 –	5.00
No. 1 soap long ton		7.00 –	.....
No. 1 Canadian, f.o.b. mill, powd long ton		20.00 –	.....
Graphite, Ceylon, lump, first quality, bbl lb.		.05½ –	.06
Ceylon, chip, bbl lb.		.04½ –	.05
High grade amorphous crude ton		15.00 –	35.00
Gum arabic, amber, sorts, bags lb.		.12 –	.12½
Gum tragacanth, sorts, bags lb.		.48 –	.53
No. 1, bags lb.		1.25 –	1.30
Kieselguhr, f.o.b. Cal ton		40.00 –	42.00
F.o.b. N.Y ton		50.00 –	55.00
Magnesite, calcined, f.o.b. Cal. ton		35.00 –	45.00
Pumice stone, imp., casks lb.		.03 –	.40
Dom., lump, bbl lb.		.06 –	.08
Dom., ground, bbl lb.		.03 –	.05
Silica, glass sand, f.o.b. Ind ton		2.00 –	2.50
Silica, sand blast, f.o.b. Ind ton		2.25	3.50
Silica, amorphous, 200-mesh, f.o.b. Ill ton		20.00 –	.....
Silica, glass sand, f.o.b. Ill ton		1.75 –	3.00
Soapstone, coarse, f.o.b. Vt., bags ton		7.50 –	8.00
Talc, 200 mesh, f.o.b., Vt., bags, extra ton		10.50 –	.....
Talc, 200 mesh, f.o.b. Ga., bags ton		8.00 –	12.00
Talc, 325 mesh, f.o.b. New York, grade A bags ton		14.75 –	.....

Mineral Oils

Crude, at Wells

Pennsylvania	bbl.	$4.00 –	$4.50
Corning	bbl.	2.15 –	.....
Cabell	bbl.	2.20 –	.....
Somerset	bbl.	2.30 –	2.50
Illinois	bbl.	2.07 –	.....
Indiana	bbl.	2.08 –	.....
Kansas and Okla. under 28 deg.	bbl.	1.00 –	.....
California, 35 deg. and up	bbl.	1.40 –	.....

Gasoline, Etc.

Motor gasoline, steel bbls	gal.	$0.20 –	.....
Naphtha, V. M. & P. deod, steel bbls	gal	.19 –	.....
Kerosene, ref. tank wagon	gal.	.15 –	.....
Bulk, W.W. delivered, N.Y.	gal.	.08½ –	.....
Lubricating oils:			
Cylinder, Penn., filtered	gal.	.32 –	.38
Bloomless, 30@31 grav	gal.	.21 –	.22
Paraffin, pale 885 vis	gal.	.17½ –	.18
Spindle, 200, pale	gal.	.22 –	.....
Petrolatum, amber, bbls	lb.	.04½ –	.04¾
Paraffine wax (see waxes)			

Refractories

Bauxite brick, 56% Al_2O_3, f.o.b. Pittsburgh	1,000	$140 –	$145
Chrome brick, f.o.b. Eastern shipping points	ton	45 –	47
Chrome cement, 40-50% Cr_2O_3	ton	23 –	27
40-45% Cr_2O_3, sacks, f.o.b. Eastern shipping points	ton	23.00	
Fireclay brick, 1st. quality, 9-in. shapes, f.o.b. Ky. wks	1,000	42 –	45
2nd. quality, 9-in. shapes, f.o.b. wks	1,000	35 –	38
Magnesite brick, 9-in. straight (f.o.b. wks.)	ton	65 –	68
9-in. arches, wedges and keys	ton	80 –	85
Scraps and splits	ton		85
Silica brick, 9-in. sizes, f.o.b. Chicago district	1,000	48 –	50
Silica brick, 9-in. sizes, f.o.b. Birmingham district	1,000	48 –	50
F.o.b. Mt. Union, Pa	1,000	38 –	40
Silicon carbide refract. brick, 9-in.	1,000	1180.00	

Ferro-Alloys

Ferrotitanium, 15-18% f.o.b. Niagara Falls, N.Y.	ton	$200.00 –	.....

Ferrochromium, per lb. of Cr, 1-2% C	lb.	$0.30	.....
4-6% C	lb.	.11½	.....
Ferromanganese, 78-82% Mn, Atlantic seabd. duty paid	gr. ton	107.50	.....
Spiegeleisen, 19-21% Mn	gr. ton	38.00	40.00
Ferromolybdenum, 50-60% Mo, per lb. Mo	lb.	2.00	2.25
Ferrosilicon, 10-12%	gr. ton	41.50	46.50
50%	gr. ton	75.00	.....
Ferrotungsten, 70-80%, per lb. of W	lb.	.85	.95
Ferro-uranium, 35-50%, of U, per lb. of U	lb.	4.50	.....
Ferrovanadium, 30-40%, per lb. of V	lb.	3.50	4.00

Ores and Semi-finished Products

Bauxite, dom. crushed, dried, f.o.b. shipping points	ton	$5.50	$8.75
Chrome ore Calif. concentrates, 50% min. Cr_2O_3	ton	22.00	.....
C.i.f. Atlantic seaboard	ton	19.00	23.00
Coke, fdry., f.o.b. ovens	ton	4.75	5.25
Coke, furnace, f.o.b. ovens	ton	3.60	4.00
Fluorspar, gravel, f.o.b. mines, Illinois	ton	23.50	.....
Ilmenite, 52% TiO_2 Va	lb.	.01½	.....
Manganese ore, 50% Mn, c.i.f. Atlantic seaport	unit	.44	.46
Manganese ore, chemica (MnO_2)	ton	75.00	80.00
Molybdenite, 85% MoS_2, per lb. MoS_2, N. Y.	lb.	.80	.....
Monazite, per unit of ThO_2, c.i.f., Atl. seaport	lb.	.06	.08
Pyrites, Span., fines, c.i.f. Atl. seaport	unit	.11½	.12
Pyrites, Span., furnace size, c.i.f. Atl. seaport	unit	.11½	.12
Pyrites, dom. fines, f.o.b. mines, Ga.	unit	.12	.....
Rutile, 95% TiO_2	lb.	.12	.15
Tungsten, scheelite, 60% WO_3 and over	unit	9.25	.....
Tungsten, wolframite, 60% WO_3	unit	9.00	9.25
Uranium ore (carnotite) per lb. of U_3O_8	lb.	3.50	3.75
Uranium oxide, 96% per lb. U_3O_8	lb.	12.25	2.50
Vanadium pent oxide, 99%	lb.	2.00	14.00
Vanadium ore, per lb. V_2O_5	lb.	1.00	1.25
Zircon, 99%	lb.	.06	.07

Non-Ferrous Metals

Copper, elec trolytic	lb.	$0.13¾	.13¾
Aluminum, 98 to 99%	lb.	.27	.28
Antimony, wholesale, Chinese and Japanese	lb.	.08½	.09
Nickel, 99%	lb.	.27	.30
Monel metal, shot and blocks	lb.	.32	
Tin, 5-ton lots, Straits	lb.	.47	
Lead, New York, spot	lb.	.0750	.....
Lead, E. St. Louis, spot	lb.	.0712½	.....
Zinc, spot, New York	lb.	.0610	
Zinc, spot, E. St. Louis	lb.	.0575	
Silver (commercial)	oz.	.64	
Cadmium	lb.	.60	
Bismuth (500 lb. lots)	lb.	2.40	2.45
Cobalt	lb.	2.50	3.00
Magnesium, ingots, 99%	lb.	.90	.95
Platinum, refined	oz.	115.00	
Iridium	oz.	275.00	300.00
Palladium	oz.	83.00	
Mercury	75 lb.	78.00	79.00
Tungsten powder	lb.	.95	1.00

Finished Metal Products

	Warehouse Price Cents per Lb.
Copper sheets, hot rolled	19.25
Copper bottoms	29.25
Copper rods	19.75
High brass wire	17.75
High brass rods	15.00
Low brass wire	19.50
Low brass rods	20.50
Brazed bronze tubing	24.34
Seamless copper tubing	22.75
Seamless high brass tubing	21.50

OLD METALS—The following are the dealers purchasing prices in cents per pound

Copper, heavy and crucible	10.25 @	10.50
Copper, heavy and wire	10.00 @	10.12½
Copper, light and bottoms	8.00 @	8.12½
Lead, heavy	5.87½ @	6.00
Lead, tea	3.50 @	3.75
Brass, heavy	5.50 @	5.75
Brass, light	4.75 @	4.87½
No. 1 yellow brass turnings	7.00 @	7.25
Zinc scrap	3.50 @	3.75

Structural Material

The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses in the cities named:

	New York	Chicago
Structural shapes	$3.59	$3.59
Soft steel bars	3.54	3.54
Soft steel bar shapes	3.54	3.54
Soft steel bands	4.39	4.39
Plates, ¼ to 1 in. thick	3.59	3.59

Industrial

Financial, Construction and Manufacturing News

Construction and Operation

Alabama

BIRMINGHAM—The Air Reduction Sales Corp., 342 Madison Ave., New York, manufacturer of industrial oxygen, acetylene gas, etc., has broken ground for the erection of its proposed local branch plant on North 29th Ave., to be used primarily for the manufacture of commercial oxygen, estimated to cost approximately $85,000. It is purposed to have the structure ready for equipment at an early date.

Arizona

MESA—The Independent Cotton & Oil Co., El Paso, Tex., Will T. Owens, president, has tentative plans under way for the erection of a new cotton oil mill on local site, estimated to cost in excess of $400,000, including equipment. The company has recently acquired the Attaway-Phelps Cotton Ginning Co., operating in this section.

California

EL MONTE—The Pacific R. & H. Chemical Co., 2575 East 9th St., Los Angeles, manufacturer of hydrocyanic acid and kindred products, has awarded a general contract to the Union Iron Works, 5125 Santa Fe Ave., Los Angeles, for the construction of a new plant on local site, consisting of two buildings, each 1-story, 60x120 ft., with wing 40x80 ft., and 60x80 ft., respectively, estimated to cost $37,000. Work will be placed in progress at once.

BAKERSFIELD—The San Joaquin Cotton Oil Co., recently organized with a capital of $100,000, has plans nearing completion for the erection of a new local plant for the manufacture of cottonseed oil. The first unit will cost about $65,000, and will be supplemented with other units at a later date. Stanley R. Pratt is president and general manager; and P. A. Williams, secretary, treasurer and superintendent.

SANTA ANA—The Standard American Glass Co., recently organized with a capital of $500,000, has plans under way for the erection of a local plant for the manufacture of window glass, to consist of a number of units estimated to cost $260,000. It is expected to have the works ready for service early in the fall, giving employment to about 250 operatives. The company has a 25-acre tract of land, and will construct additional buildings later to advance the working force to about 500 persons. The Los Angeles Chamber of Commerce is interested in the project, which is headed by E. J. Williams, Long Beach, Calif., who will be general manager at the plant.

MERCED—The Yosemite Portland Cement Co. is making ready for the early installation of machinery at its new local mill on the Oakdale Rd., now in course of construction, and expects to have the plant ready for operation early in the fall. It will represent an investment in excess of $250,000. E. N. Baker is secretary.

FULLERTON—The Western Glass Co. has filed plans for the erection of additional buildings at its new local plant, now in course of construction and purposes to construct other units later. The entire works will represent an investment of about $200,000, with equipment.

CASTROVILLE—The Arca Tile Mfg. Co. has perfected plans for the operation of a local plant for the manufacture of roofing and flooring tile, to replace its former works at Santa Barbara, Calif. It is expected to develop an extensive capacity. Joseph Arca, Sr. and Jr., head the company.

RIPON—The Meyenberg Evaporated Milk Co., Salinas, Calif., has plans nearing completion for the erection of a new local plant, with capacity in excess of 90,000 lb. per day. The works are estimated to cost close to $60,000, including machinery. John B. and Walter Meyenberg head the company.

Florida

TAMPA—The United States Export Chemical Co., 476 1st Ave., North, St. Petersburg, Fla., is making ready for active construction on its proposed local plant on the Alafia River for the manufacture of superphosphate fertilizer products. The main structure will be 110x230 ft., and supplemented with power house and other auxiliary buildings. An electric traveling crane will be installed. The entire plant will cost in excess of $100,000, with equipment. Peter S. Gilchrist, president of the Chemical Construction Co., Charlotte, N. C., is an official of the company.

JACKSONVILLE—Farris & Co., meat packers, have acquired a tract of property adjoining their factory and plan for the erection of a new plant for the manufacture of soap products, to be 2-story, estimated to cost $30,000. N. E. Farris is president.

PENSACOLA—The Pure Oil Co., Pure Oil Bldg., Columbus, O., has made application for permission to construct and operate an oil storage and distributing plant on the waterfront, with capacity of about 1,000,000 gal., estimated to cost $250,000, with equipment.

Illinois

CHICAGO—The William D. Hodson & Sons Co., manufacturer of special lubricants, has leased property in the Clearing Industrial district, totaling about 30,000 sq.ft. of land, and will occupy a 1-story building to be erected on the site, for expansion in operations. It is said that the present works will be removed to the new location.

LOCKPORT—The Barrows Lock Co. is having plans drawn for the erection of a new 1-story brass foundry, 63x100 ft., estimated to cost about $23,000. A list of equipment to be installed will soon be arranged. Charles W. Webster, Cutting Bldg., Joliet, Ill., is architect.

Indiana

DUNKIRK—The Indiana Glass Co. has awarded a general contract to the Austin Co., Euclid Ave., Cleveland, O., for the erection of a 1-story addition to its plant, 88x110 ft., to be used as a lehr building. It is estimated to cost $40,000. Frank Murray is president.

Louisiana

NEW ORLEANS—The Barber Entomological Laboratories, manufacturers of insecticides, etc., has preliminary plans under advisement for the establishment of a number of branch plants at different points in the south. Laboratories will be installed at the various points.

Michigan

MILAN—The American Boiler & Foundry Co., recently formed with a capital of $50,000, has plans in progress for the construction of a new foundry for the production of iron castings. E. L. Watson is president and general manager.

IRON MOUNTAIN—The Common Council has plans under way for the installation of a new filtration plant in connection with water storage reservoir, estimated to cost $190,000.

Missouri

ST. LOUIS—The Hemple Paper Co., 1122 North 13th St., plans for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $17,500, including equipment.

ST. LOUIS—Work will be placed in progress on the rebuilding of the portion of the enameling plant of the Moon Motor Car Co., 4410 North 2nd St., recently destroyed by fire with loss estimated at $21,000.

Montana

MISSOULA—The Chicago, Milwaukee & St, Paul Railway Co., is reported to be planning for the construction of an oil-refining plant, for fuel for locomotive service, on the Knowles property, to cost approximately $85,000.

New York

LONG ISLAND CITY—The United Sanitary Products Co., 65 5th Ave., New York, manufacturer of liquid soaps, moth fluids,

etc., is planning for the erection of a new 4-story plant on site acquired at Foster Ave. and Buckley St., totaling about 11,000 sq.ft. of ground area. It is estimated to cost close to $100,000, including equipment. Benjamin Newman is president.

CORNING—The Corning Fibre Box Co., an interest of the Corning Industries, Inc., plans for the construction of a new 1-story addition to its plant, 100x120 ft., with improvements in the present works, estimated to cost $50,000. A. M. Tietzel is company architect.

North Carolina

CANTON—The Champion Coated Paper Co., Hamilton, O., has acquired control of the Champion Fibre Co., and has plans under way for extensions, to include the installation of a new paper-making machine, finishing equipment, etc., estimated to cost in excess of $175,000. Work will be commenced at an early date.

THOMASVILLE—The Pneu-Mechanic Tire Co., recently organized, has tentative plans for the establishment of a local plant for the manufacture of special pneumatic tires. Charles R. Thomas is president, and A. H. Regan, secretary.

North Dakota

DEVILS LAKE—The Northwestern Iron Works, Inc., has preliminary plans under advisement for the construction of a new 1-story foundry on 2nd St., for iron-casting production. S. A. Hann is president.

Ohio

CHILLICOTHE—The Mead Pulp & Paper Co. has awarded a general contract to the H. K. Ferguson Co., Cleveland, for the erection of a new local plant, comprising a number of units, estimated to cost close to $200,000, including equipment. It is expected to have the first unit available for the machinery installation within 60 days, with other buildings closely following.

LANCASTER—The Hocking Glass Co., manufacturer of table glassware, etc., has work in progress on the rebuilding of the portion of its plant recently destroyed by fire, and plans for the early installation of four lehrs and other equipment.

WARREN—The Fleischmann Co., 701 Washington St., New York, manufacturer of yeast, has acquired the local plant of the Research Products Co., and will take immediate possession. It will be used as a branch plant. Plans are under way for extensions and improvements, including the installation of additional equipment.

MASSILLON—The Realty Rubber Co. is perfecting plans for the early erection of the portion of its plant recently destroyed by fire. It will cost close to $50,000. It is purposed to install additional equipment. W. A. Sonnhalter is president.

Oklahoma

GUTHRIE—The Guthrie Gas Co. has plans under advisement for extensions and betterments in its plant to cost about $75,000, including additional equipment.

Pennsylvania

CREIGHTON—The Pittsburgh Plate Glass Co., Frick Bldg., Pittsburgh, has authorized the construction of a second unit at its local plate glass plant, duplicating the initial plant buildings, now practically completed, with rated output of about 20,000,000 ft. of glass per annum. The estimated cost has not been announced. It is expected to commence work at an early date.

PHILADELPHIA—The Publicker Commercial Alcohol Co., Water St. and Snyder Ave., has awarded a general contract to the Murphy & Quigley Co., 1524 Sansom St., for the erection of a new 2-story building at its plant, estimated to cost $37,000. Clarence E. Wunder, 1520 Locust St., is architect.

LATROBE—The Vanadium Alloy Steel Co. has completed plans and will begin the erection of a new 1-story building at its plant, 45x175 ft., estimated to cost $34,000. Hunting & Davis, Century Bldg., Pittsburgh, are architects.

Rhode Island

PHILLIPSDALE—The Bird Paper Mill is reported to be planning for the reconstruction of the building at its local plant recently destroyed by fire with loss estimated at $40,000.

Tennessee

MURFREESBORO—The Tennessee Rubber Co. has tentative plans for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $17,000.

Texas

SAN ANTONIO—The National Carbonic Co., 202 Blue Star St., recently formed with a capital of $60,000, is perfecting plans for the erection of a 1-story plant, 57x75 ft., for the production of carbon dioxide gas and kindred products. A list of equipment to be installed will be arranged at an early date. H. P. Goodman is president.

AMARILLO—Dorset Carter, Oklahoma City, Okla., and associates are said to have plans under advisement for the construction of a local oil-refining plant. It is purposed to construct a pipeline from the Carson County oilfields for crude oil supply.

Utah

GUNNISON—The Gunnison Sugar Co. has acquired the local beet sugar mill of the Gunnison Valley Sugar Co., with rating of 800 tons capacity, and other assets. Plans are projected for extensions and improvements in the mill. A working capital of $500,000 is being arranged. The purchasing company is controlled by the William Wrigley, Jr. Co., Chicago, Ill., manufacturer of chewing gum.

West Virginia

PIEDMONT—The Common Council is arranging for a bond issue of $30,000, for the installation of a chlorination and filtration plant at the municipal waterworks, recently approved by citizens at a special election. Plans will be prepared at an early date.

Canada

CORNWALL, ONT.—The Howard Smith Paper Mills, Ltd., is planning for the rebuilding of the portion of its plant recently destroyed by fire with loss estimated at $30,000, including equipment.

GUELPH, ONT.—The Malt Products Co., Ltd., has tentative plans for the construction of a new chemical laboratory and other departments to replace the portion of its works recently destroyed by fire with loss of about $135,000, including equipment.

New Companies

NEW JERSEY WAX PAPER CO., Rutherford, N. J.; wax and other special papers; $30,000. Incorporators: Charles Hall, Clarence C. Meleney and Charles D. Lewis, all of Rutherford.

VITOGRA CHEMICAL CO., Lowell, Mass.; chemicals and chemical byproducts; $10,000. H. M. Knapp is president; and Arthur H. Johnson, 71 Wyman St., Woburn, Mass., treasurer and representative.

RIVERDALE PRODUCTS CO., 327 South La Salle St., Chicago, Ill.; fertilizers, chemicals, etc.; $20,000. Incorporators: George A. Chapman and George Tasker.

RESOLUTE OIL CO., Los Angeles, Calif.; refined petroleum products; $1,500,000. Incorporators: Egbert Van Alen, J. J. Warrick and John Morris. Representative: Bertin A. Weyl, 606 Spring Arcade Bldg., Los Angeles.

HOLBROOK-HUGHES CORP., New York, N. Y.; paints, oils, varnishes, etc.; active capital, $45,500. Incorporators: H. Hausman and D. Strumpf. Representative: Gallert, Hilborn & Raphael, 141 Broadway, New York.

CINO CHEMICAL PRODUCTS CO., Cincinnati, O.; chemicals and chemical byproducts; $20,000. Incorporators: E. C. and Ralph Bloom, both of Cincinnati.

AIRCOOL SPARK PLUG CORP., Miami, Fla.; porcelain spark plugs, etc.; $300,000. Incorporators: P. S. Campbell (president); and Charles S. Zonne, (secretary), both of Miami.

NORTH BERGEN TILE CO., Jersey City, N. J.; tile and kindred ceramic products; 2,000 shares of stock, no par value. Incorporators: John F. McGlew, Jr., and George Koeffler. Representative: Warren, Britt & Stanton, 921 Bergen Ave., Jersey City.

NATIONAL CARBONIC CO., San Antonio, Tex.; acids, chemical specialties, etc.; $60,000. Incorporators: H. P. Goodman and Guy Borden, both of San Antonio.

PRISCILLA CHEMICAL CO., 1040 State St., Chicago, Ill.; polishes, cleaners, etc.; nominal capital $3,000. Incorporators: James A. Rush, Charles W. Ebbert, and Robert H. Bastert.

CASTLE KID CO., New York, N. Y.; operate a leather tannery; $1,000,000. Incorporators: H. F. Mela, L. S. Popkin and R. A. Seligmann. Representative: Hirsch, Sherman & Limberg, 160 Broadway, New York.

SCHOONMAKER LABORATORIES, INC., West Caldwell, N. J.; chemicals and chemical byproducts; 1,000 shares of stock, no par value. Incorporators: Stacy B. Ganow, William H. and Frederick W. Schoonmaker, West Caldwell. The last noted is representative.

KLEAN-OIL MFG. CO., INC., Detroit, Mich.; oil compounds for cleaning service; $30,000. Incorporators: Charles C. Conklin, Joseph V. McKeon and Ralph F. Martindale, 736 East Jefferson Ave., Detroit. The last noted is representative.

HUNTINGTON LEATHER CO., Huntington, W. Va.; leather tannery; $50,000. Incorporators: R. L. Archer, and J. C. Hardin, 728 7th Ave., Huntington. The last noted will act as president.

LACQUER & CHEMICAL CORP., New York, N. Y.; chemicals, chemical compounds, etc.; $20,000. Incorporators: S. Friedman and C. Brown. Representative: Reuben Brown, 261 Broadway, New York, attorney.

MICHIGAN PAINT MFG. CO., Grand Rapids, Mich.; paints, varnishes, etc.; $10,000. Incorporators: E. D. McFarland, Frank W. Hine and Robert H. McFarland, 338 Richard Terrace, Grand Rapids. The last noted is representative.

SUPERIOR OIL CO., Trenton, N. J.; refined oil products; $100,000. Incorporators: James Howard, James Kerwick, and Donald R. Bryant, 505 Broad Street Bank Bldg., Trenton. The last noted is representative.

UNIVERSAL POLISH MFG. CO., care of Charles G. Guyer, 826 Market St., Wilmington, Del., representative; polishes, cleaning compounds, etc.; $100,000.

RAD PRODUCTS CO., Buffalo, N. Y.; soaps, cleansers, etc.; $10,000. Incorporators: J. Sweeney and J. A. Kelly. Representative: Killeen, Sweeney & Kelly, Buffalo, attorneys.

SEMINOLE PAINT CO., Jacksonville, Fla.; paints, varnishes, oils, etc.; capital not stated. Incorporators: J. A. LaValle and J. F. Bell, both of Jacksonville. The first noted will act as president.

MARYLAND OIL CO. OF CALIFORNIA, San Francisco; refined petroleum products; $5,000,000. Incorporators: Franklin R. Kenney, Ponca City, Okla.; Carl H. Beal, San Mateo, Calif.; and Monroe H. Goode, Burlingame, Calif.

Industrial Notes

THE SULLIVAN MACHINERY CO., Chicago, has moved its Pittsburgh office into larger quarters in the Farmers Bank Bldg. William R. Jarvis has been the Sullivan manager at Pittsburgh since 1904.

THE BRISTOL CO., Waterbury, Conn., manufacturer of recording instruments and distributor of radio equipment, has leased space in the Larkin Bldg., 3617 South Ashland Avenue, Chicago, in order adequately to take care of the Middle West business. Most of the area will be devoted to repairing and recalibrating Bristol instruments sold and used in the Chicago territory, but some will be used for stock made-up instruments for quick deliveries and various lines of radio merchandise. The present salesroom and offices of the Bristol Co. will be maintained in the Monadnock Bldg.

THE WILSON WELDER & METALS CO., 132 King St., New York City, on account of increased demand for welding machines and welding wire, has moved its plant and general offices to the Wilson Bldg., Hoboken Factory Terminal, Hoboken, N. J.

HOUCHIN-AIKEN CO., INC., Hawthorne, N. J., engineer and machinist of soap, candle, glycerine and chemical machinery, has moved its New York office to 50 Church St., Room 367. The main office is located at the factory at Hawthorne, N. J.

ROGERS, BROWN & CO., of Buffalo and Cincinnati, have taken over under contract the distribution of the aluminum products of the Niagara Smelting & Refining Corporation of Buffalo. W. H. Hopkins, city manager of Cleveland, is president of the Niagara Smelting & Refining Corporation. The company is producing aluminum and aluminum alloys at the rate of 14 tons daily, and this capacity will be expanded. Rogers, Brown & Co. will handle these products through their national selling organization.